DOCUMENT RESUME

ED 253 713 CE 040 698

AUTHOR Gregory, Margaret R.; Benson, Robert T.
TITLE Mechnical Drawing/Drafting Curriculum Guide.
INSTITUTION South Carolina State Dept. of Education, Columbia. Office of Vocational Education.
PUB DATE 84
NOTE 132p.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS Behavioral Objectives; Classroom Techniques; Competency Based Education; *Drafting; *Engineering Drawing; Engineering Graphics; Equipment Utilization; Evaluation Criteria; *Freehand Drawing; Geometric Concepts; Learning Activities; Letters (Alphabet); Orthographic Projection; Resources; Secondary Education; Spatial Ability; State Curriculum Guides; Student Evaluation; Teaching Methods; *Technical Education; *Technical Illustration; Visualization
IDENTIFIERS *Computer Assisted Drafting

ABSTRACT

This curriculum guide consists of materials for teaching a course in mechanical drawing and drafting. Addressed in the individual units of the guide are the following topics: the nature and scope of drawing and drafting, visualization and spatial relationships, drafting tools and materials, linework, freehand lettering, geometric construction, multiview projections, sectional views, auxiliary views, axonometric projections, oblique projections, perspectives, and machine drafting. Each unit contains some or all of the following: series of duty and task statements, series of performance objectives, suggested learning activities, lists of suggested resources, lists of tools and equipment needed to complete the unit, evaluation criteria, and transparency masters. Concluding the guide is a bibliography of works dealing with mechanical drawing and drafting. (MN)

MECHANICAL DRAWING/DRAFTING

Curriculum Guide

Prepared by

Margaret R. Gregory
Project Coordinator

Robert T. Benson, ED.D
Technical Coordinator

SOUTH CAROLINA DEPARTMENT OF EDUCATION

Dr. Charlie G. Williams, State Superintendent of Education

Division of Instruction
Sidney B. Cooper, Deputy Supervisor

Office of Vocational Education
Dr. Moody M. Oswald, Jr., Director

South Carolina Department of Education: An Equal Opportunity Agency
Columbia, South Carolina 29201

ACKNOWLEDGMENTS

The **Mechanical Drawing/Drafting Curriculum Guide** was developed by a team of vocational instructors in South Carolina. Their expertise in the area of mechanical drawing and drafting is greatly appreciated. The State staff members in the Trade and Industrial Education Section and in the Sex Equity Section were helpful in serving as resource persons.

Charles G. Moore
T & I Supervisor
Office of Vocational Education

Joseph E. Bunn
T & I Consultant
Office of Vocational Education

Dr. Annie S. Winstead
Sex Equity Consultant
Office of Vocational Education

Clanton Austell
Irmo-Chapin Career Center
Columbia, South Carolina

Wayne Chapman
R. D. Anderson Vocational Center
Moore, South Carolina

James D. Horton
Richland Northeast High School
Columbia, South Carolina

Patricia E. Kinsey
Editor
Office of Vocational Education

Barbara Richardson
Word Processing Operator
Office of Vocational Education

Mary Gantt
Graphic Arts Student
Lexington I Area Vocational Center

TABLE OF CONTENTS

FIELD REVIEW

The field review of the **Mechanical Drawing/Drafting Curriculum Guide** was conducted in the winter of 1983. The teachers involved were William Ferguson (Andrew Jackson High School), Benjamin Hall (Eau Clair High School), Heywood Elliott (Floyd D. Johnson Vocational Center), and Donald K. Aull (Airport High School).

Copies of the Guide were inserviced with the committee members. Each member was asked to make comments or corrections in the Guide and then to complete a questionnaire. Overall, the responses were positive with few changes. This Guide is unique in that it does not focus on any one particular course of study. Parts or sections may be pulled for industrial arts, mechanical drawing, basic drafting, blueprint reading, or building construction, just to name a few. Because of its versatility, several features are incorporated. First, more topics are introduced for classroom instruction. Secondly, more activities are included than were basically necessary to teach the concept; the teacher has the flexibility to adapt to student needs. Thirdly, no suggested instructional time is allotted for each lesson since the Guide may be used in many subject areas.

Based on its versatility, an important feature of the Guide is its potential to enhance or supplement several courses of study.

The State Office of Vocational Education appreciates the time and effort the field review team put into critiquing the Guide.

INTRODUCTION

Vocational instructors in building construction, drafting, mechanical drawing, and other related occupations cross over in their instruction into curricula which have been represented in the **Mechanical Drawing/Drafting Curriculum Guide.** The Guide is prepared to partially accommodate the void in each of these courses of study. The instructor may incorporate any part or section to supplement the course outline.

The **Mechanical Drawing/Drafting Curriculum Guide** is composed of lesson guides with objectives, learning activities, resources, tools, and evaluation techniques. The lesson guides are designed to give guidance in teaching a task or concept and may be altered to adapt to the needs of the class. No attempt is made to separate tasks or learning activities into learning levels or abilities except where one skill is needed to build onto an advanced skill. Otherwise, the adaptation to learning levels is left to the discretion of the instructor.

The resources cited in each of the lesson guides are current information and readily available. Some handouts are provided to reinforce the instruction; these handouts are in addition to the exercises in the text. The Writing Team emphasized throughout the Guide the need to demonstrate the drawings and then have the students practice the same drawing--under the watchful eye of the instructor.

DUTY: ORIENTATION TO DRAWING/DRAFTING

TASK: Present a report on the origins and history of drawing/drafting

PERFORMANCE OBJECTIVE

Given lecture and reference materials, the student will be able to write or present orally a report of approximately 1,500 words on the origins and history of drawing/drafting with 90% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignments and resources from reference materials.

II. Explain the procedure for note taking and the organizational methods to be used with reference materials.

III. Have students write an outline of the history of drawing/drafting.

IV. Review and discuss the outlines regarding the sequence of events.

V. Set the deadline for the reports to be presented in class.

VI. After the presentations, discuss any misunderstandings or deletion of facts.

RESOURCES

French, et al. **Mechanical Drawing,** 8th ed., Chapter 1
Spence. **Drafting Technology and Practice,** Chapter 1
Encyclopedia Americana
World Book Encyclopedia

TOOLS AND EQUIPMENT

None

EVALUATION

The student will write or present orally a report of approximately 1,500 words on the origins and history of drawing/drafting with 90% accuracy.

DUTY: ORIENTATION TO DRAWING/DRAFTING

TASK: Explain the duties and responsibilities of a drafter and the career opportunities

PERFORMANCE OBJECTIVE

Given lecture and reference materials, the student will be able to list and explain at least five career opportunities in drawing/drafting and the duties and responsibilities of a drafter with 90% accuracy.

LEARNING ACTIVITIES

I. Explain and discuss the information in the texts.

II. Have students bring in "Help Wanted" ads from newspapers and select available drawing/drafting jobs. Place the ads in a scrapbook or on a bulletin board for future reference.

III. Have students call up drafting/drawing job opportunities on a SCOIS terminal and discuss.

IV. Discuss dress and conduct requirements for drafters.

V. Discuss salaries and wages earned in the drawing/drafting field.

VI. Discuss advantages and disadvantages of being a drafter.

VII. Explain the duties and responsibilities of a drafter.

VIII. Explain and demonstrate how to complete a job application and have students complete an application.

IX. Role play an interview with students.

X. Invite a local drafter, architect, or engineer to class to discuss job opportunities in drafting/drawing.

RESOURCES

Wright. **Drafting,** pp. 1-15
French and Svenson. **Mechanical Drawing,** 7th ed., Chapter 1
French, et al. **Mechanical Drawing,** 8th ed., Chapter 1
South Carolina Occupational Information Service (SCOIS)
Classified section with "Help Wanted" ads from a large newspaper, i.e., **The State/Record, The Greenville News, The New York Times, Wall Street Journal**
Job Seeking: How & Where

TOOLS AND EQUIPMENT

Scissors, pencils, notebooks, scrapbook, cellophane tape or rubber cement

EVALUATION

The student will locate five jobs in drawing/drafting for which he/she will be qualified upon graduation. The student will describe the duties and responsibilities of a drafter with 90% accuracy.

DUTY: ORIENTATION TO DRAWING/DRAFTING

TASK: Demonstrate the proper use and care of drafting/drawing equipment

PERFORMANCE OBJECTIVE

Given lecture, demonstrations, equipment, and reading materials, the student will be able to complete a teacher-developed test on the use and care of drawing/drafting equipment with 85% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Explain the responsibility each student has for the care of the assigned equipment, the cost, and how it is acquired. (IMPORTANT)

III. Demonstrate each piece of equipment to be used and the proper care of each.

IV. Demonstrate and lecture on safety precautions in the classroom.

V. Distribute the equipment. Have each student select one item and identify and describe its use and care.

RESOURCES

French, et al. **Mechanical Drawing,** 8th ed., Chapter 3
Spence. **Drafting Technology and Practice,** Chapter 4

TOOLS AND EQUIPMENT

Drawing board with cover sheet, T-square, parallel bar or drafting machine, 30^{o} / 60^{o} triangle, 45^{o} triangle, compasses and dividers with cases, pencils or leadholders with lead, eraser, art gum, erasing shield, dry cleaning pad, small cloth, drafting brush

EVALUATION

The student will complete a teacher-developed test on the use and care of drawing/drafting equipment with 85% accuracy. The student will demonstrate the proper use and care of five items of drawing/drafting equipment.

DUTY: VISUALIZATION AND SPATIAL RELATIONSHIPS

TASK: Define terminology for visualization and spatial relationships

PERFORMANCE OBJECTIVE

Given lecture and demonstration of vocabulary and terminology, the student will be able to complete a teacher-developed test on the vocabulary/terminology for visualization and spatial relationships with 80% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignments.

II. Explain the importance of using the correct vocabulary and terminology in drafting/drawing.

III. Distribute and explain a list of words common to visualization and spatial relationships such as graphics, communication, and visualization.

IV. Demonstrate various terms and procedures required as a basis for drawing/drafting such as:
   A. Sketch
   B. Lay out
   C. Construct
   D. Dimension

V. Explain the three main types of drawings made by drafters (schematic, multiview, and pictorial) and draw examples on the board or distribute teacher-developed handout.

RESOURCES

French, et al. **Mechanical Drawing,** 8th ed., Chapter 1 and Appendix E
Spence. **Drafting Technology and Practice,** Chapter 1 and 2
French and Vierck. **Engineering Drawing and Graphic Technology,** Glossary (A1-A8)

TOOLS AND EQUIPMENT

None

EVALUATION

The student will complete a teacher-developed test on the vocabulary/terminology for visualization and spatial relationships with 80% accuracy.

DUTY: VISUALIZATION AND SPATIAL RELATIONSHIPS

TASK: Sketch basic technical line work (freehand)

PERFORMANCE OBJECTIVE

Given lecture, demonstrations, and materials, the student will be able to sketch straight horizontal, inclined, and vertical lines freehand with 1/16" or less deviation per 6", and circles and arcs freehand accurate to 1/16".

LEARNING ACTIVITIES

I. Explain and demonstrate at least two methods each of sketching horizontal, inclined, and vertical lines freehand and how to check freehanded lines for straightness.

II. Have students sketch horizontal lines freehand, choosing their own method.

III. Check each student's method individually and make necessary corrections.

IV. Have students sketch vertical and inclined lines freehand, choosing their own method.

V. Check each student's method individually and make necessary corrections.

VI. Explain and demonstrate at least two methods each of sketching circles and arcs freehand.

VII. Have students sketch circles and arcs, choosing their own method.

VIII. Check each student's work individually and make necessary corrections.

IX. Have students practice additional exercise problems either taken from the text or developed by the instructor.

RESOURCES

French, et al. **Mechanical Drawing**, 8th ed., Chapter 2

TOOLS AND EQUIPMENT

Pencils, eraser, unlined paper, chalkboard

EVALUATION

The student will sketch 6" horizontal and 6" vertical lines freehand, with a maximum of 1/16" deviation and circles and arcs as assigned with a maximum of 1/16" error.

DUTY: VISUALIZATION AND SPATIAL RELATIONSHIPS

TASK: Represent objects by using orthographic projection

PERFORMANCE OBJECTIVE

Given lecture, demonstration, and suitable equipment, the student will be able to complete a drawing representing the concept of orthographic projection with 90% accuracy.

LEARNING ACTIVITIES

I. Define orthographic projection and explain why we use it.

II. Demonstrate how an orthographic projection is constructed using conventional drawing equipment.

III. Have students construct orthographic projections of various objects.

RESOURCES

French, et al. **Mechanical Drawing**, 8th ed., pp. 9-10, 22,31
French and Vierck. **Engineering Drawing and Graphic Technology**, Chapter 5

TOOLS AND EQUIPMENT

Straight edge, 45°/90° triangle, drafting tape, T-square, drawing board, pencils, eraser, paper, chalkboard

EVALUATION

The student will demonstrate the concept of orthographic projection by completing drawings with 90% accuracy.

DUTY: VISUALIZATION AND SPATIAL RELATIONSHIPS

TASK: Making pictorial sketches

PERFORMANCE OBJECTIVE

Given lecture and demonstration, student will be able to make pictorial sketches (isometric, oblique, one-point, and two-point perspective drawings) of an object with 85% accuracy.

LEARNING ACTIVITIES

I. Explain and demonstrate pictorial sketches.
   A. Isometric axes and drawings of straight lines, arcs, and curves
   B. Oblique drawings in cabinet and cavalier forms, circles, arcs, and curves
   C. One-point and two-point perspective drawings

II. After each demonstration, have students practice making the sketch. Check each student's work.

III. Review by comparing the student's sketch with the text. Demonstrate corrections.

IV. Have students practice additional exercise problems either taken from the text or developed by the instructor.

RESOURCES

French, et al. **Mechanical Drawing,** 8th ed., Chapters 2 and 12
French and Vierck. **Engineering Drawing and Graphic Technology,** 12th ed., Chapter 8

TOOLS AND EQUIPMENT

Straight edge, pencils, eraser, unlined paper, chalkboard or overhead projector, transparencies

EVALUATION

The student will complete pictorial sketches (isometric, oblique, one-point and two-point perspective drawings) of an object with 85% accuracy.

DUTY: VISUALIZATION AND SPATIAL RELATIONSHIPS

TASK: Perform technical sketching of two-dimensional objects

PERFORMANCE OBJECTIVE

Given lecture and demonstration, the student will be able to sketch ten views of two-dimensional objects with 85% accuracy: five views freehand and five views with the aid of a straight edge.

LEARNING ACTIVITIES

I. Define and demonstrate:
   A. A technical sketch
   B. How to represent visual objects
   C. Line qualities
   D. Line intersections
   E. Parallel lines
   F. How to build up images of objects

II. After each demonstration, have students complete the drawing. Check each student's work.

III. Review each sketch for clarity.

IV. Have students practice additional exercise problems either taken from the text or developed by the instructor.

RESOURCES

French, et al. **Mechanical Drawing,** 8th ed., Chapter 2

TOOLS AND EQUIPMENT

Pencils, eraser, unlined paper, straight edge, chalkboard

EVALUATION

The student will visualize and sketch ten objects selected by the instructor with 85% accuracy.

DUTY: DRAFTING TOOLS AND MATERIALS

TASK: Identify the components of computer-aided drafting

PERFORMANCE OBJECTIVE

Given classroom instruction and a field trip, the student will be able to complete an instructor-developed test on the components of a computer-aided drafting system with 80% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Conduct a field trip to local industry where CAD is used.

III. Create a bulletin board showing CAD components.

IV. Duplicate and distribute copies of articles on CAD systems from recent periodicals.

V. Invite a vendor of small CAD systems to class for demonstration.

RESOURCES

Local vendor of CAD systems

Brown. **Drafting for Industry**, Chapter 21, pp. 426-433

Goetsch. **The CAD/CAM Workbook**, pp. 1-81

"Using A Computer As A Drafting Tool," **School Shop**, May 1982, Vol. 41, No. 10

"Computer-Aided Drafting," **Industrial Education**, May/June 1981, Vol. 70, No. 5

TOOLS AND EQUIPMENT

Bulletin board, CAD components

EVALUATION

The student will complete an instructor-developed test on the components of a computer-aided drafting system with 80% accuracy.

DUTY: DRAFTING TOOLS AND MATERIALS

TASK: Describe the use of drafting tools

PERFORMANCE OBJECTIVE

Given classroom instruction, the student will be able to list and briefly describe the use of ten drafting tools with 85% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Create a static display of drafting tools attached to a board with names under the tools.

III. Demonstrate each drafting tool.

IV. Assign problems from text for students to practice drawing using each tool.

V. Assign a full set of tools to each student (or student may purchase his/her own).

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 18-25
Brown. **Drafting for Industry**, pp. 19-38

TOOLS AND EQUIPMENT

Set of drawing tools: pencil/lead holder, lead pointer, scale, 30°/60° triangle, 45°/90° triangle, protractor, irregular curve, compass, dividers, erasing shield, sandpaper, eraser, brush, T-square/parallel bar/drafting machine

EVALUATION

The student will list and describe the use of ten drafting tools with 85% accuracy.

DUTY: DRAFTING TOOLS AND MATERIALS

TASK: Identify drafting mediums

PERFORMANCE OBJECTIVE

Given samples of eight drafting mediums, the student will identify six of the eight samples with 85% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Create static display or bulletin board showing various mediums.

III. Invite a supply salesperson to talk to class and show various mediums.

IV. Give samples of mediums to each student.
- A. Drawing paper
- B. Vellum
- C. Mylar
- D. Print paper
- E. Graphite lead
- F. Plastic lead
- G. Ink
- H. Sepia

V. Have student draw drafting problems on various mediums.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing,** p. 21
Brown. **Drafting for Industry,** pp. 24-25
Local supply salesperson

TOOLS AND EQUIPMENT

Samples of various drafting mediums

EVALUATION

The student will identify six samples of the eight drafting mediums with 85% accuracy.

DUTY: DRAFTING TOOLS AND MATERIALS

TASK: Divide a size "D" sheet of drawing paper

PERFORMANCE OBJECTIVE

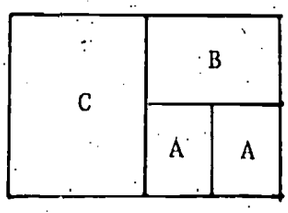
Given a size "D" sheet of drawing paper, the student will divide the "D" size sheet into one "C" size, one "B" size and two "A" size sheets of paper.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Create a static display or bulletin board showing standard paper sizes.

III. Demonstrate the procedure for cutting a large sheet into smaller sheets.



D

IV. Have students draw the smaller sizes on the size "D" sheet of drawing paper.

V. Have students cut smaller sheets from the larger sheet of drawing paper on cutting board.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 21, 43
Brown. **Drafting for Industry**, p. 25

TOOLS AND EQUIPMENT

Cutting board, drawing paper (size "D")

EVALUATION

The student will divide a "D" size sheet of paper into one "C" size, one "B" size, and two "A" size sheets of paper.

DUTY: DRAFTING TOOLS AND MATERIALS

TASK: Identify graphite grades from softest to hardest

PERFORMANCE OBJECTIVE

Given a list of several grades of graphite (lead), the student will be able to list them in order from softest lead to hardest lead with 100% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Create a chart or bulletin board to show graphite grades in order from softest to hardest.

III. Distribute the soft, medium, and hard grades of graphite to the students.

IV. Have students draw problems with various grades of graphite using the mechanical lead holders.

V. Have students draw problems with various grades of wooden pencils.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing,** pp. 22-23
Brown. **Drafting for Industry,** p. 26

TOOLS AND EQUIPMENT

Various grades of graphite lead

EVALUATION

The student will list graphite grades in order from softest lead to hardest lead with 100% accuracy.

DUTY: LINEWORK

TASK: Identify alphabet of lines

PERFORMANCE OBJECTIVE

Given classroom instruction, the student will be able to complete an instructor-developed test on identifying the alphabet of lines with 85% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Have students create a chart of the alphabet of lines.

III. Obtain prints from industry and point out or label the various lines.

IV. Assign textbook exercises that involve practice in drawing each type of line.

V. Draw each line on the overhead projector or chalkboard.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 23-25
Brown. **Drafting for Industry**, pp. 26-29

TOOLS AND EQUIPMENT

Overhead projector, screen

EVALUATION

The student will complete an instructor-developed test on identifying the alphabet of lines with 85% accuracy.

DUTY: LINEWORK

TASK: Describe importance of linework

PERFORMANCE OBJECTIVE

Given classroom instruction, the student will be able to list five reasons why good linework is important with 80% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Develop and discuss a transparency listing the reasons for good linework.

III. Create a drawing with bad linework and a drawing with good linework and compare the two drawings.

IV. Obtain prints from industry and let students observe the quality of linework.

V. Run prints of a drawing at various speeds to show the quality of linework.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing,** pp. 102-105
Brown. **Drafting for Industry,** p. 27

TOOLS AND EQUIPMENT

Overhead projector, screen, print machine

EVALUATION

The student will list five reasons why good linework is important with 80% accuracy.

DUTY: FREEHAND LETTERING

TASK: Describe importance of freehand lettering

PERFORMANCE OBJECTIVE

Given classroom instruction, the student will be able to list five reasons why good freehand lettering is important with 80% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Create a transparency listing the reasons for good freehand lettering.

III. Create a drawing with correct lettering and a drawing with incorrect lettering and compare the two drawings.

IV. Obtain prints from industry and let students observe lettering quality.

V. Have students develop a list of reasons why lettering is important.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 51-54
Brown. **Drafting for Industry**, pp. 67-68

TOOLS AND EQUIPMENT

Overhead projector, screen

EVALUATION

The student will list five reasons why good freehand lettering is important with 80% accuracy.

DUTY: FREEHAND LETTERING

TASK: Using the lettering guide

PERFORMANCE OBJECTIVE

Given drawing paper, pencils, and lettering guide, the student will be able to draw guidelines 1/16" apart, 1/8" apart, 3/16" apart and 1/4" apart.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Demonstrate the proper use of the lettering guide.

III. Develop exercises for students that involve drawing parallel lines.

IV. Assign textbook problems which require the use of guidelines for lettering.

V. Review and discuss any difficulties the students had in preparing the drawings.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 54-55, 66-67
Brown. **Drafting for Industry**, pp. 68-69, 77-78

TOOLS AND EQUIPMENT

Lettering guides, overhead projector, screen, grease pencil, necessary drawing tools

EVALUATION

The student will draw guidelines 1/16" apart, 1/8" apart, 3/16" apart, and 1/4" apart.

DUTY: FREEHAND LETTERING

TASK: Make letter formations

PERFORMANCE OBJECTIVE

Given drawing paper and drafting tools, the student will be able to properly freehand letter all letters and numerals of the Gothic (single stroke, vertical, and capital) lettering style according to the formation chart and standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Demonstrate the letter formations on overhead projector or chalkboard.

III Assign practice sheets involving letter formation exercises.

IV. Assign lettering problems and exercises from textbook.

V. Have students practice lettering with various grades of graphite.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 56-57, 66-67
Brown. **Drafting for Industry**, pp. 69-70, 77-78

TOOLS AND EQUIPMENT

Overhead projector, grease pencil, necessary drawing tools

EVALUATION

The student will freehand letter all letters and numerals of the Gothic (single stroke, vertical, and capital) lettering style according to the formation chart and standards set by the instructor.

DUTY: FREEHAND LETTERING

TASK: Freehand letter a note

PERFORMANCE OBJECTIVE

Given drawing paper, tools, and written instructions, the student will be able to freehand letter a given note according to evaluation standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Demonstrate proper letter spacing on overhead projecto or chalkboard.

III. Assign practice sheets involving freehand lettering notes.

IV. Assign note problems from textbook.

V. Assign drawing problems which include notes as part of the drawing.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 56-57, 66-67
Brown. **Drafting for Industry**, pp. 72-74, 77-78

TOOLS AND EQUIPMENT

Overhead projector, screen, grease pencil, necessary drawing tools

EVALUATION

The student will freehand letter a given note according to evaluation standards set by the instructor.

26

DUTY: GEOMETRIC CONSTRUCTION

TASK: Describe the effect history has had on geometric construction and the results

PERFORMANCE OBJECTIVE

Given classroom discussion and illustrations, the student will be able to explain in writing the effect that geometry has had on the evolution of design with 70% accuracy.

LEARNING ACTIVITIES

I. Describe the effect of geometry on the designs of the ancient Egyptians, Assyrians, and Babylonians and on the lintel.

II. Explain how surveying was used by the Egyptians for precisely laying out large structures and cites.

III. Explain how the Greeks theorized about geometry and were able to take advantage of principles that resulted in the classical style of architecture.

IV. Identify and explain the theories that describe surfaces, edges, and points.

V. Define and explain the use of plane, ruled, single-curved, and warped surfaces.

RESOURCES

Geachino and Beukema. **Drafting and Graphics,** pp. 55-81
Giesecke, et al. **Technical Drawing,** pp. 1-7, 87-118

TOOLS AND EQUIPMENT

Chalkboard and chalk

EVALUATION

The student will explain in writing the effect geometry has had on the evolution of design with 70% accuracy.

DUTY: GEOMETRIC CONSTRUCTION

TASK: Construct a series of geometric constructions

PERFORMANCE OBJECTIVE

Given classroom discussion, demonstrations, and necessary drawing tools, the student will be able to construct 25 geometry solutions with 70% accuracy.

LEARNING ACTIVITIES

I. Review the definitions and rules that apply to basic geometry and construction.

II. Demonstrate the construction of:
   A. Bisection and division
   B. Locations of centers of circles and areas
   C. Tangencies
   D. Polygons
   E. Ellipses and truncated cylinders

III. Distribute handout and have students practice the geometric constructions discussed in class.

IV. Have students complete the handout to show that they understand the different constructions.

V. Review the completed handout. Point out the difficult constructions.

RESOURCES

Geachino and Beukema. **Drafting and Graphics**, pp. 55-81

TOOLS AND EQUIPMENT

Chalkboard, chalk, chalkboard compass with straight-edge, parallel bar, compass, 45° triangle

EVALUATION

The student will construct 25 geometry solutions with 70% accuracy.

DUTY: GEOMETRIC CONSTRUCTION

TASK: Prepare a technical drawing

PERFORMANCE OBJECTIVE

Given classroom instruction, demonstrations, and necessary drawing tools, the student will be able to produce at least two technical drawings that demonstrate the ability to apply geometry skills with 70% accuracy.

LEARNING ACTIVITIES

I. Assign a drawing problem to assess the student's ability to:
   A. Divide lines
   B. Bisect
   C. Locate centers
   D. Construct tangencies
   E. Construct polygons and ellipses

II. Demonstrate the correct drawing of each of the geometric constructions.

III. Have students practice the correct procedures.

IV. Select students to demonstrate on the chalkboard the proper drawings and to identify the characteristics of each.

V. Discuss the practical uses of these drawings in industry.

RESOURCES

Geachino and Beukema. **Drafting and Graphics,** pp. 32-37
Worksheets

TOOLS AND EQUIPMENT

Drawing board, parallel bar, compass, scale, 45° triangle

EVALUATION

The student will produce at least two technical drawings that demonstrate the ability to apply geometry skills with 70% accuracy.

GEOMETRIC CONSTRUCTIONS

NAME

DATE

SCALE

A-

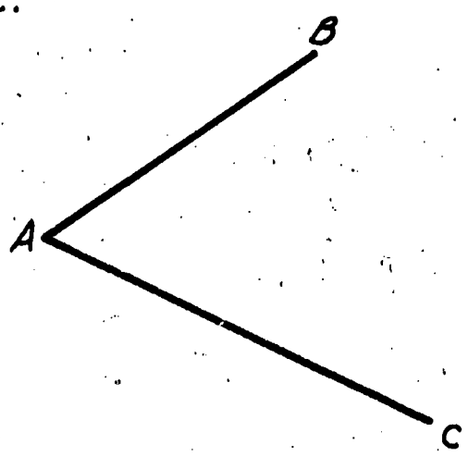
GIVEN :

REQUIRED :

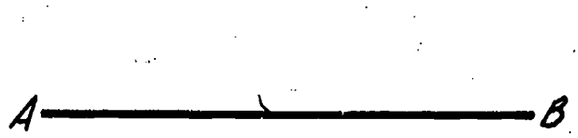
1. BISECT LINE AB

2. BISECT ARC AB

3. BISECT ANGLE BAC.



4. DRAW A LINE PARALLEL TO LINE AB AT THE GIVEN DISTANCE R1.



GEOMETRIC CONSTRUCTIONS

NAME

SCALE

DATE

A-

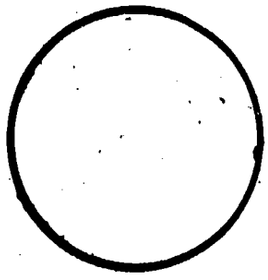
GIVEN :

REQUIRED :

5. DIVIDE LINE AB INTO 5 EQUAL PARTS.

A ——————— B

6. LOCATE THE CENTER OF THE CIRCLE.



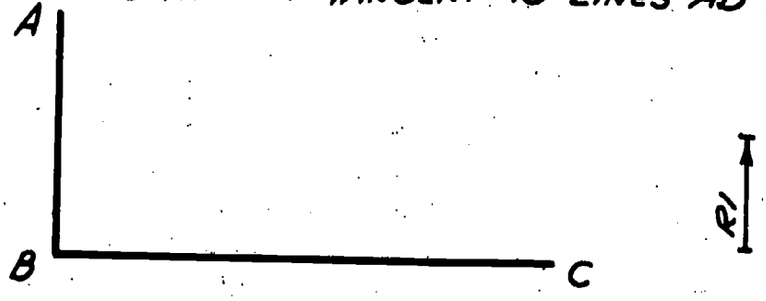
7. DRAW AN ARC THROUGH POINTS A, B, AND C.

B

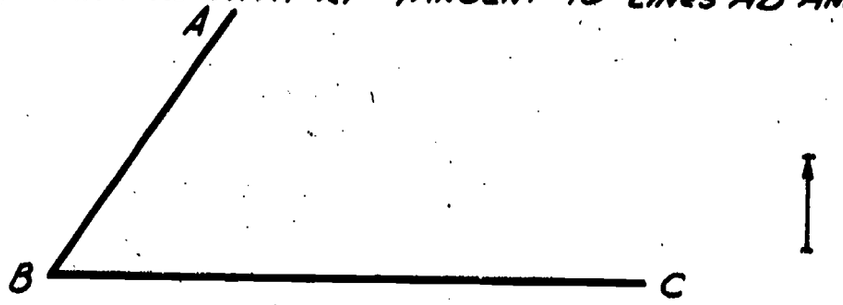
C

A

8. DRAW AN ARC WITH R1 TANGENT TO LINES AB AND BC (@ 90°).



9. DRAW AN ARC WITH R1 TANGENT TO LINES AB AND BC (NOT AT 90°)



GEOMETRIC CONSTRUCTIONS

NAME

SCALE

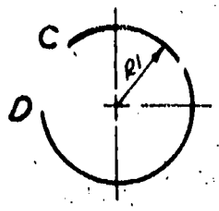
DATE

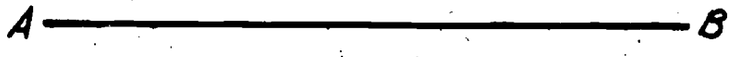
A-

GIVEN :

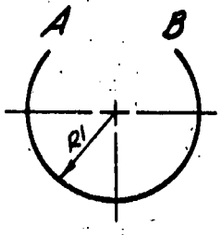
REQUIRED :

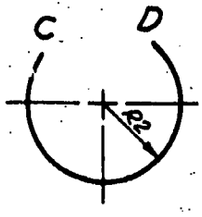
10. DRAW AN ARC OF GIVEN RADIUS R2 TANGENT TO LINE AB AND ARC CD.



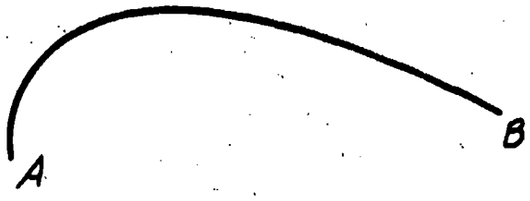


11. DRAW AN ARC TANGENT TO ARCS AB AND CD USING THE GIVEN RADIUS R3. (EXTERNAL)

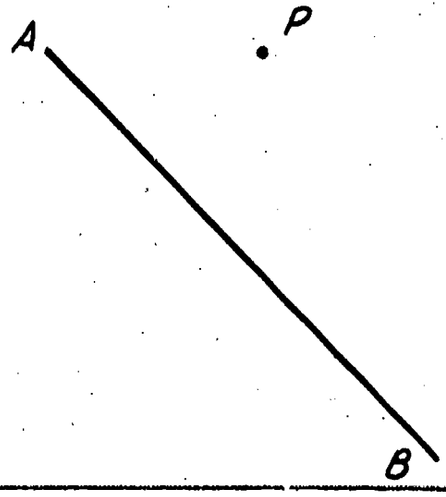




12. DRAW A CURVED LINE PARALLEL TO LINE AB AT THE GIVEN SEPARATION R1.



13. DRAW A LINE PARALLEL TO LINE AB THROUGH POINT P.



GEOMETRIC CONSTRUCTIONS

NAME

SCALE

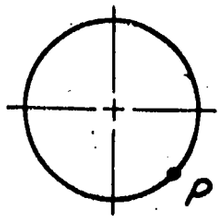
DATE

A-

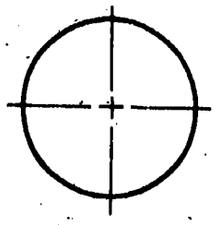
GIVEN :

REQUIRED :

14. DRAW A LINE TANGENT TO A CIRCLE THROUGH A POINT (P) ON THE CIRCLE.

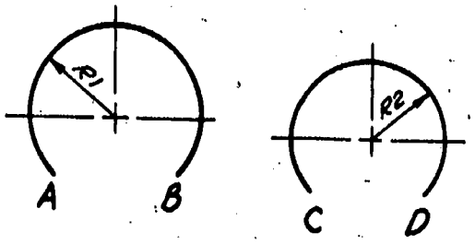


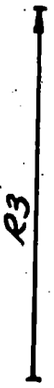
15. DRAW A LINE TANGENT TO A CIRCLE THROUGH A POINT (P) OUTSIDE THE CIRCLE.



P

16. DRAW AN ARC TANGENT TO ARCS AB AND CD USING THE GIVEN RADIUS R3. (INTERNAL)





GEOMETRIC CONSTRUCTIONS

NAME

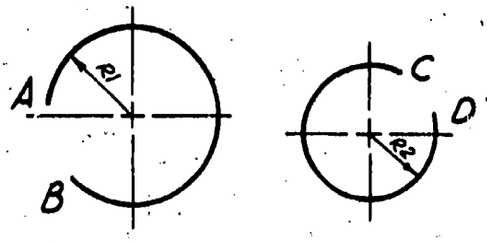
SCALE

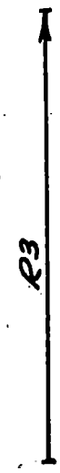
DATE

A-

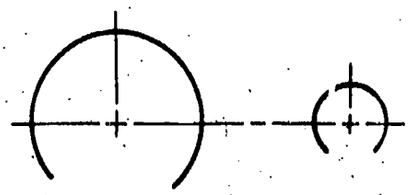
17. DRAW AN ARC TANGENT TO ARCS AB AND CD (INTERNAL/EXTERNAL) USING THE GIVEN RADIUS R3.

GIVEN : REQUIRED :

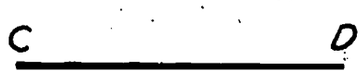




18. DRAW A LINE TANGENT TO TWO ARCS.



19. DRAW AN OGEE CURVE CONNECTING POINTS B AND C.



GEOMETRIC CONSTRUCTIONS

NAME

SCALE

DATE

A-

GIVEN :

REQUIRED :

20. DRAW A HEXAGON WITH KNOWN DISTANCE AB ACROSS FLATS.

A ⟷ B

21. DRAW A HEXAGON WITH KNOWN DISTANCE ACROSS CORNERS.

A ⟷ B

22. DRAW A REGULAR POLYGON WITH SEVEN SIDES (EACH SIDE = AB) SHOW ALL CALCULATIONS.

A B

GEOMETRIC CONSTRUCTIONS

NAME

SCALE

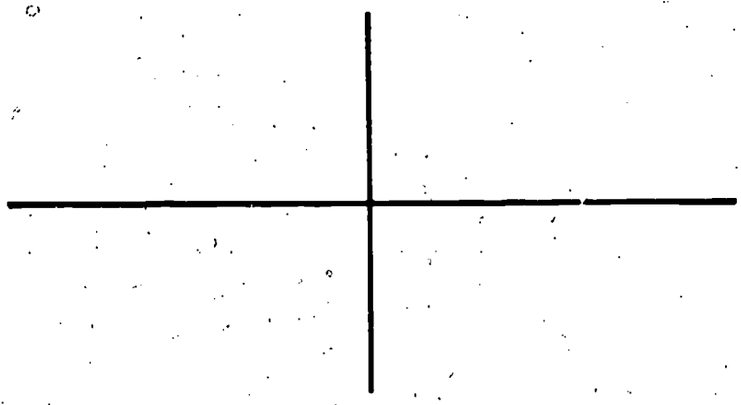
DATE

A-

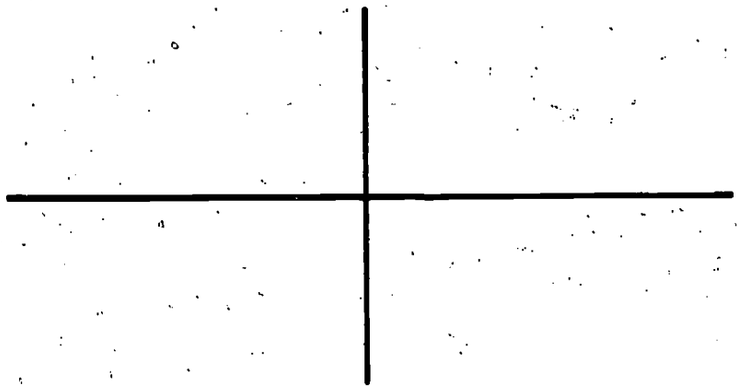
GIVEN :

REQUIRED :

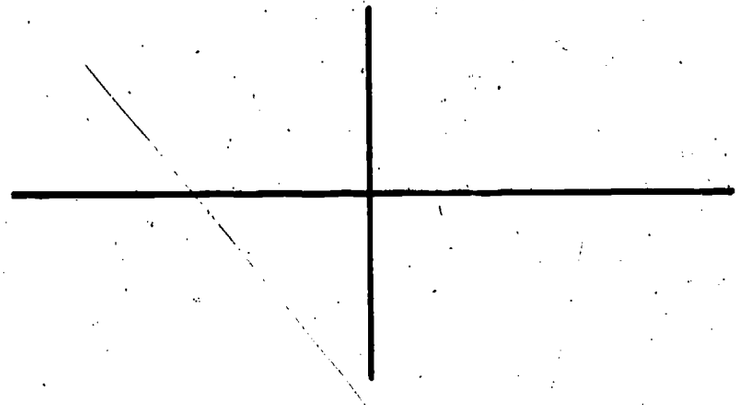
23. DRAW AN ELLIPSE FOCI METHOD.



24. DRAW AN ELLIPSE TRAMMEL METHOD. (ATTACH TRAMMEL TO THIS SHEET)



25. DRAW AN ELLIPSE CONCENTRIC CIRCLE METHOD.



DUTY: MULTI-VIEW PROJECTIONS

TASK: Define terms related to multi-view projections

PERFORMANCE OBJECTIVE

Given reading assignments and classroom discussions, the student will be able to define in writing the basic terms as they apply to technical drawing with 85% accuracy.

LEARNING ACTIVITIES

I. Describe and discuss the concepts of spatial relations.

II. Explain the process of describing shapes.

III. Explain the relationship between spatial relations and orthographic projections.

IV. Help students complete a series of three-view orthographic projections using a worksheet.

V. Explain and demonstrate the glass box method of projecting regular views.

VI. Explain projection and transferring points to adjacent views.

VII. Demonstrate how all points on a three-dimensional view can be located on each of the regular orthographic views.

VIII. Have students label points on views using a handout.

RESOURCES

Geachino and Beukema. **Drafting and Graphics**, pp. 89-96
Gresecke, et al. **Technical Drawing**, pp. 153-160
Worksheet

TOOLS AND EQUIPMENT

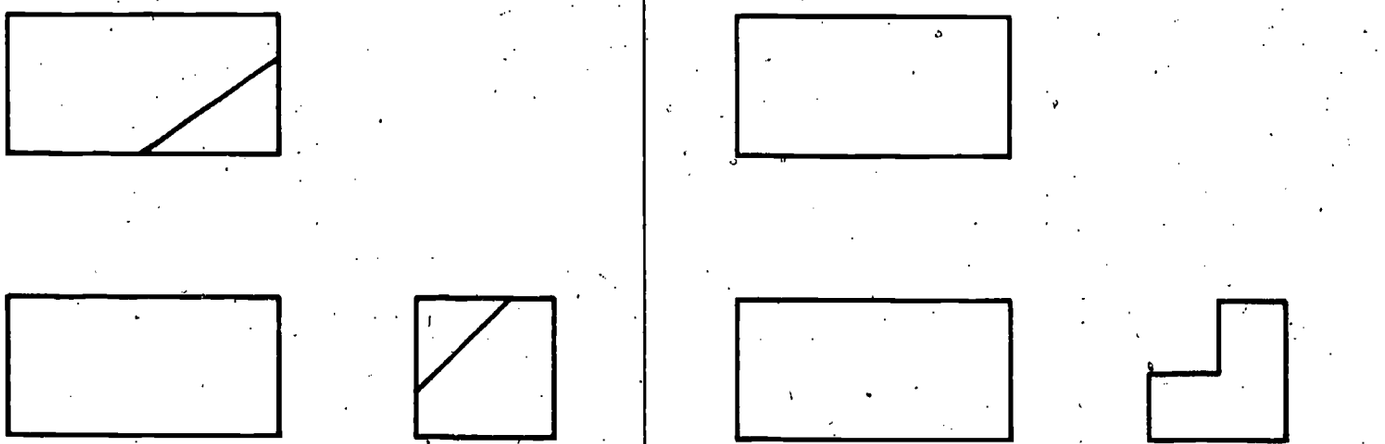
Chalkboard, chalk, overhead projector, screen, transparency, grease pencil, 30°/60° triangle, 45° triangle, parallel bar

EVALUATION

The student will define in writing the basic terms as they apply to technical drawing with 85% accuracy.

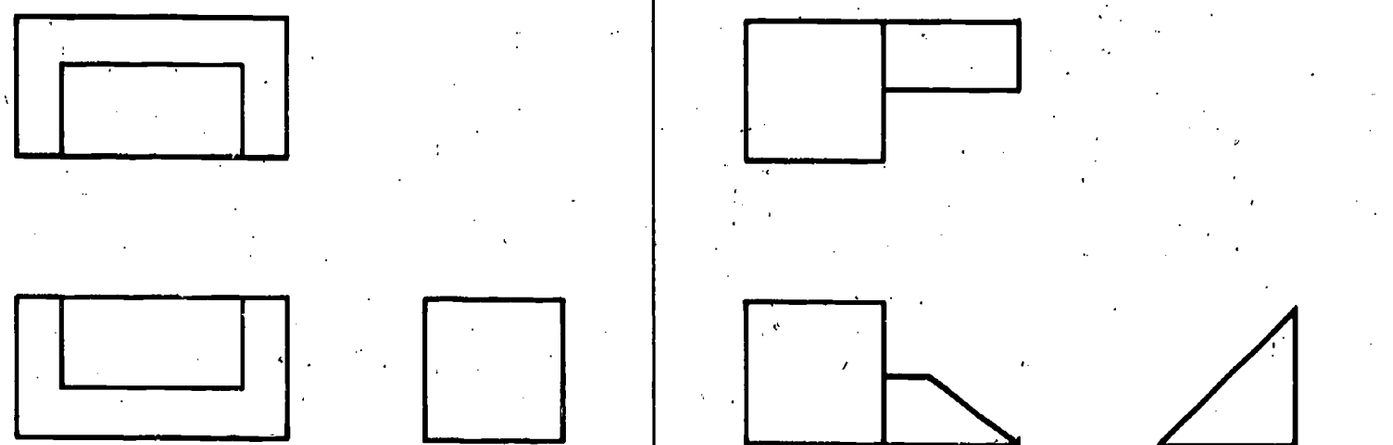
GIVEN: FOUR 3-VIEW MULTI-PROJECTIONS.

REQUIRED: ADD THE MISSING LINES.



1. 2.

3. 4.



MULTI-VIEW PROJECTIONS

NAME

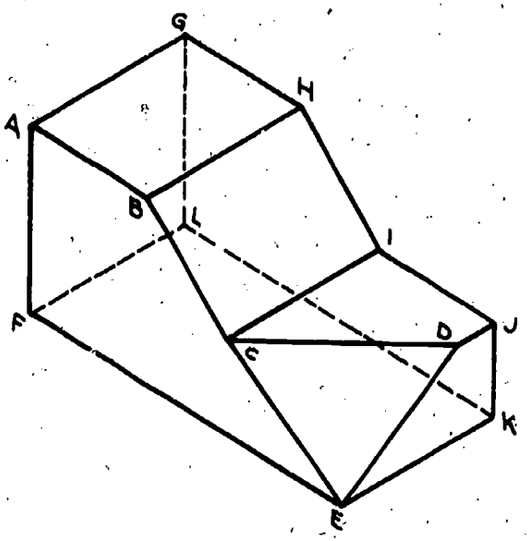
SCALE: FULL

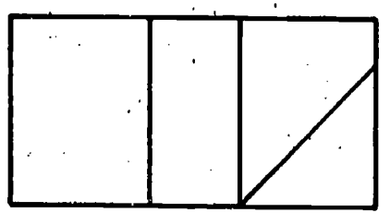
DATE:

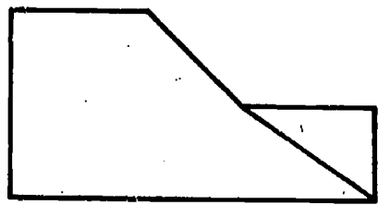
A-

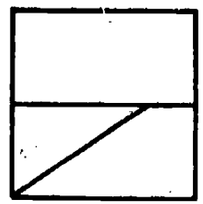
JDH 1-83

GIVEN: PICTORIAL AND THREE-VIEW ORTHOGRAPHIC.
REQUIRED: LABEL ALL POINTS ON ORTHOGRAPHICS.









41

MULTI-VIEW PROJECTIONS	NAME	SCALE: FULL DATE:	A-

DUTY: MULTI-VIEW PROJECTIONS

TASK: Explain the relationships between conventional practices and orthographic views

PERFORMANCE OBJECTIVE

Given text assignment, classroom discussion, and illustrations, the student will be able to identify and produce at least one drawing using conventional practices with a maximum of five errors.

LEARNING ACTIVITIES

I. Explain and illustrate alternate positions.

II. Demonstrate and explain partial views.

III. Explain and demonstrate revolution conventions.

IV. Describe removed views.

V. Explain conventional breaks.

VI. Distribute handout and have students project an orthographic drawing utilizing conventional drawing practices explained in class.

VII. Have students complete the worksheet of drawing exercises.

VIII. Discuss the results of the worksheet in class for further clarification.

RESOURCES

Giesecke, et al. **Technical Drawing**, pp. 161-163
Worksheets

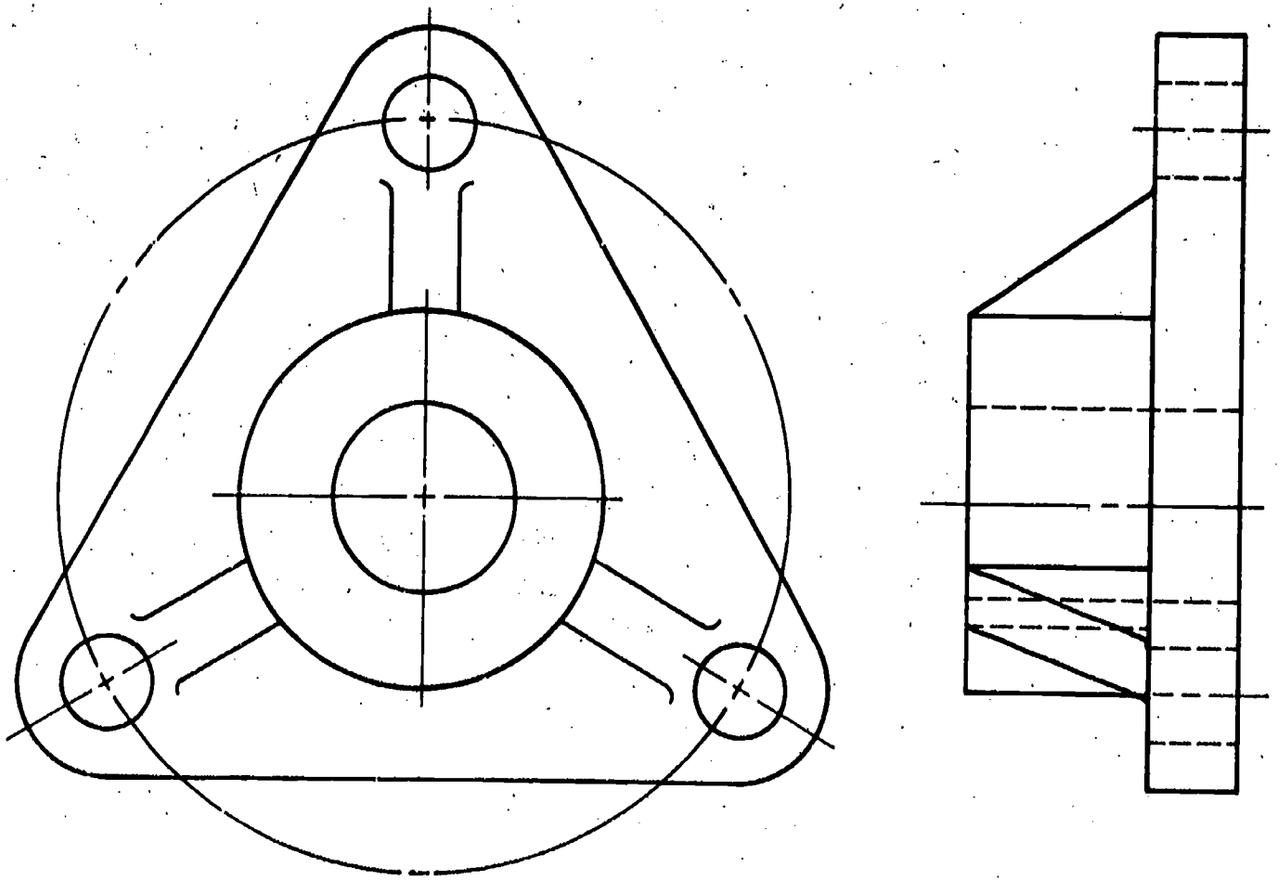
TOOLS AND EQUIPMENT

Chalkboard, chalk, overhead projector, screen, transparency, grease pencil, 30°/60° triangle, 45° triangle, bar compass, 12" architectural scale, parallel bar

EVALUATION

The student will identify and produce at least one drawing using conventional practices with a maximum of five errors.

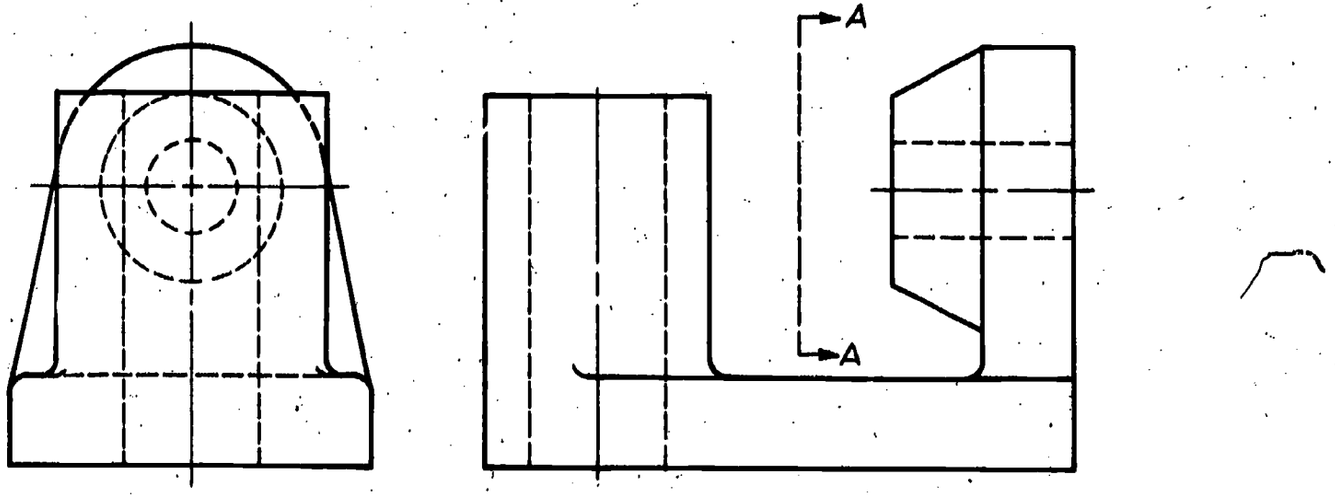
GIVEN: FRONT AND RIGHT SIDE VIEWS.
REQUIRED: REVOLVED RIGHT SIDE VIEW.



43

REVOLVED VIEW	NAME	SCALE: FULL DATE:	A-

GIVEN : FRONT AND RIGHT SIDE VIEWS.
REQUIRED : REMOVED VIEW USING VIEWING-PLANE A-A.

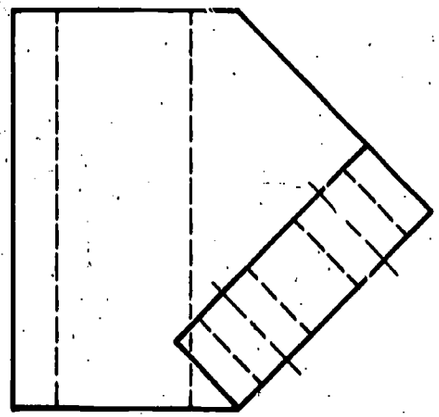


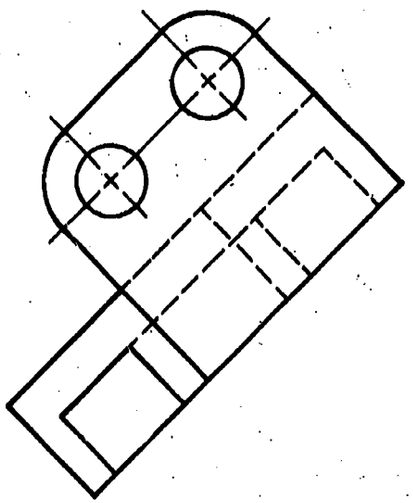
44

REMOVED VIEW	(NAME)	SCALE : FULL DATE :	A-

GIVEN: TOP AND PRIMARY (HEIGHT) AUXILIARY VIEWS.

REQUIRED: PARTIAL FRONT VIEW.





45

PARTIAL VIEW	NAME	SCALE: FULL	A-
		DATE:	

DUTY: MULTI-VIEW PROJECTIONS

TASK: Describe the components of solid objects

PERFORMANCE OBJECTIVE

Given necessary information, classroom discussion, and illustrations, the student will be able to identify and describe the surfaces and edges in drawings of solid objects with 85% accuracy.

LEARNING ACTIVITIES

I. Explain and demonstrate the various classes of surfaces and edges.

II. Describe and illustrate how angles may appear in an orthographic projection.

III. Explain and illustrate how curved surfaces are represented in orthographics.

IV. Explain how positive and negative forms appear in orthographics.

V. Explain and demonstrate how the intersection of surfaces may appear in multi-view drawings.

VI. Have students complete the worksheet to identify surfaces and edges and to locate points in adjacent views.

VII. Discuss the results of the worksheet in class.

RESOURCES

Giesecke, et al. **Technical Drawing**, pp. 166-178
Worksheet

TOOLS AND EQUIPMENT

Chalkboard, chalk, overhead projector, screen, transparency, $30^{o}/60^{o}$ triangle, 45^{o} triangle, parallel bar

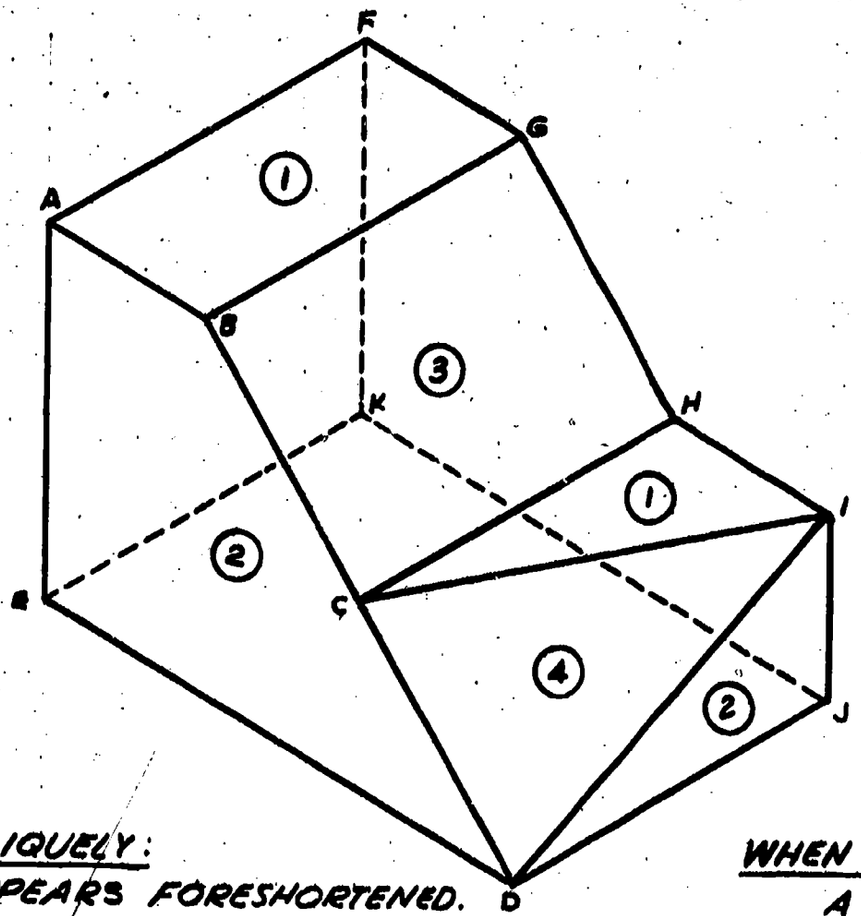
EVALUATION

The student will identify and describe the surfaces and edges in drawings of solid objects with 85% accuracy.

SURFACES

1. HORIZONTAL
2. VERTICAL
3. INCLINED
4. OBLIQUE

WHEN VIEWED PERPINDUCLAR:
A PLANE APPEARS IN ITS TRUE SIZE AND SHAPE.
A LINE APPEARS IN ITS TRUE LENGTH.

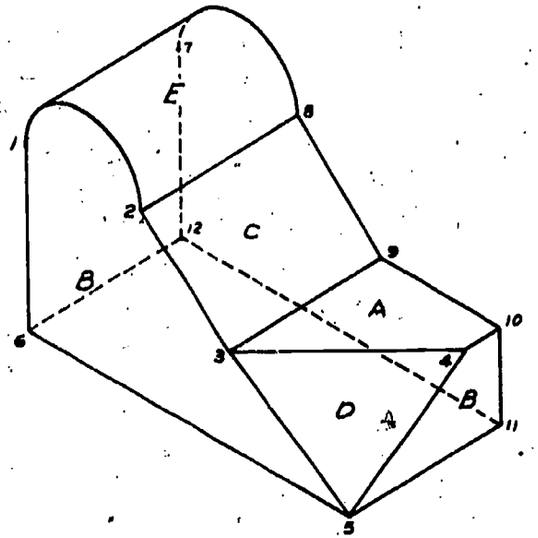


WHEN VIEWED OBLIQUELY:
A PLANE APPEARS FORESHORTENED.
A LINE APPEARS FORESHORTENED.

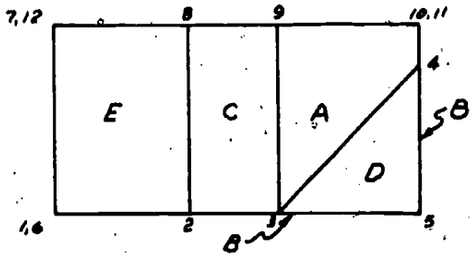
WHEN VIEWED ON EDGE:
A PLANE APPEARS AS A LINE.
A LINE APPEARS AS A POINT.

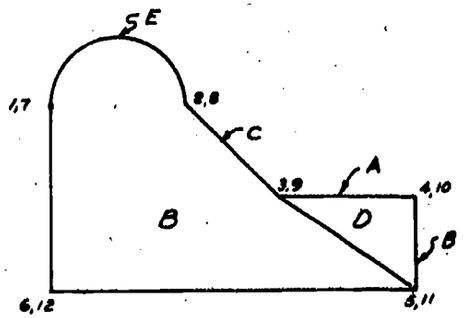
GIVEN : PICTORIAL AND THREE-VIEW ORTHOGRAPHIC.

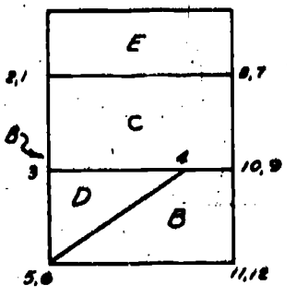
REQUIRED : IDENTIFY SURFACES, EDGES, AND POINTS.



48







___ HORIZONTAL (NORMAL) SURFACE.
___ VERTICAL (NORMAL) SURFACE.
___ INCLINED SURFACE
___ OBLIQUE SURFACE
___ SINGLE CURVED SURFACE
___ EDGE VIEW OF AN INCLINED SURFACE.
___ FORESHORTENED OBLIQUE SURFACE.
___ INTERSECTION OF INCLINED AND HORIZONTAL SURFACES.
___ POINT VIEW OF LINE
___ FORESHORTENED OBLIQUE LINE.
___ FORESHORTENED INCLINED EDGE.

SURFACES, EDGES, & POINTS	NAME	SCALE: FULL DATE:	A-

DUTY: MULTI-VIEW PROJECTIONS

TASK: Identify and duplicate the alphabet of lines

PERFORMANCE OBJECTIVE

Given classroom instruction and illustrations, the student will be able to identify and duplicate the "alphabet of lines" with 100% accuracy.

LEARNING ACTIVITIES

I. Explain and demonstrate the following symbols:
   A. Varied line
   B. Visible line
   C. Hidden line
   D. Phantom line
   E. Center and axis line

II. Discuss the importance of using the correct symbol.

III. Distribute and discuss the worksheet.

IV. Have students examine and duplicate the sample line symbols.

V. Discuss the results of the worksheet in class.

RESOURCES

Giesecke, et al. **Technical Drawing**, p. 22

TOOLS AND EQUIPMENT

Overhead projector, screen, transparency, grease pencil, parallel bar

EVALUATION

The student will identify and duplicate the "alphabet of lines" with 100% accuracy.

GIVEN : ALPHABET OF LINES.

REQUIRED : DUPLICATE THE ALPHABET OF LINES.

ALPHABET OF LINES

VISIBLE LINE	THICK	
HIDDEN LINE	MEDIUM	$\frac{1}{8} \times \frac{1}{32}$
CENTER LINE	THIN	$\frac{1}{8} \times \frac{1}{16}$
PHANTOM LINE	THIN	$\frac{1}{8} \times \frac{1}{16} \times 8 \quad \frac{1}{16} \times \frac{3}{4}$
CUTTING PLANE LINES	THICK THICK	$\frac{1}{4} \times \frac{1}{16}$ $\frac{1}{8} \times \frac{1}{16} \times \frac{3}{4}$
SECTION LINE	THIN	
SHORT BREAK	THICK	
LONG BREAK	THIN	
DIMENSION, EXTENSION, LEADER.	THIN	2.50

50

ALPHABET OF LINES	NAME	SCALE DATE	A-

DUTY: MULTI-VIEW PROJECTIONS

TASK: Trace an orthographic projection

PERFORMANCE OBJECTIVE

Given instruction, demonstration, and materials, the student will be able to prepare an orthographic projection that describes an object's shape and size with a maximum of five errors.

LEARNING ACTIVITIES

I. Explain and display the different types of drafting mediums available.

II. Identify the different types of leads.

III. Explain the sequence for preparing a set of orthographic views.

IV. Explain the sequence for tracing the various features of shape description and size description.

V. Demonstrate the procedure for checking your work.

VI. Distribute a handout for students to apply their knowledge of tracing an orthographic.

RESOURCES

Giesecke, et al. **Technical Drawing**, pp. 153-163
Teacher-prepared handout

TOOLS AND EQUIPMENT

Overhead projector, screen, parallel bar, triangles, compass

EVALUATION

The student will prepare an orthographic projection that describes an object's size and shape with a maximum of five errors.

DUTY: MULTI-VIEW PROJECTIONS

TASK: Describe the size of an object

PERFORMANCE OBJECTIVE

Given classroom instruction and illustrations, the student will be able to describe the size of an object drawn in orthographic form with a maximum of one error.

LEARNING ACTIVITIES

I. Explain the reason for scaling a drawing to a specific size.

II. Discuss how dimensions are used to describe sizes and how to select which dimensions should be used.

III. Discuss the importance of dimension placement on a drawing.

IV. Discuss the placement of fractions and decimals.

V. Explain and illustrate:
   A. Circular features
   B. Curved surfaces
   C. Location of holes

VI. Distribute the worksheet and have students practice placing dimensions.

VII. Review the worksheet and discuss how dimensions were used to describe the size of the objects.

RESOURCES

Giesecke, et al. **Technical Drawing**, pp. 297-331
Worksheet

TOOLS AND EQUIPMENT

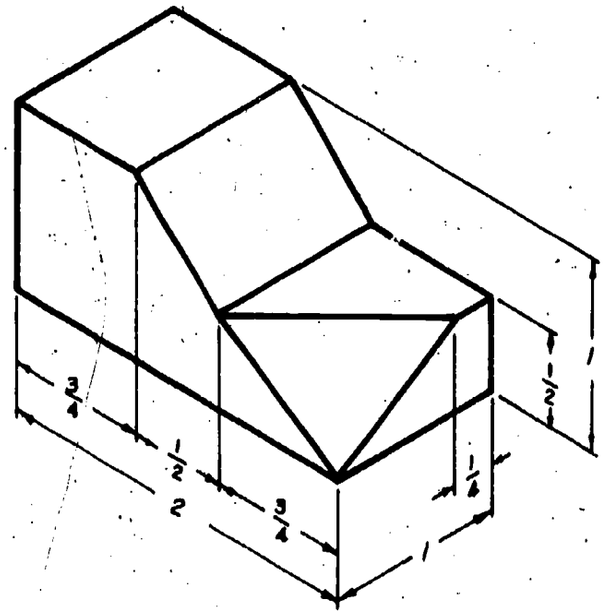
Overhead projector, screen, transparency, grease pencil, parallel bar, 45° triangle, 6" compass

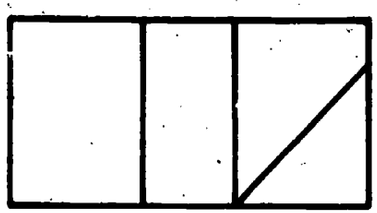
EVALUATION

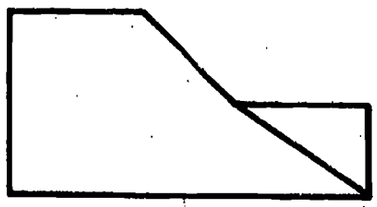
The student will describe the size of an object drawn in orthographic form with a maximum of one error.

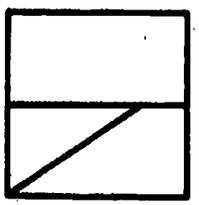
GIVEN : DIMENSIONED ISOMETRIC & UNDIMENSIONED ORTHOGRAPHICS.

REQUIRED : DIMENSION THE THREE VIEW ORTHOGRAPHIC.









53

DIMENSIONING

NAME

SCALE FULL

DATE

A-

DUTY: SECTIONAL VIEWS

TASK: Identify types of sectional views

PERFORMANCE OBJECTIVE

Given reference materials and classroom discussion, the student will be able to complete a teacher-developed test on identifying types of sectional views.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Distribute teacher-developed study questions to be answered in student's notebook.

III. Demonstrate theory of sectional views with objects or static displays.

IV. Demonstrate sectional views by sketching on transparency or chalkboard.

V. Assign sketching exercises for student practice.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing,** Chapter 11, pp. 279-280
Brown. **Drafting for Industry,** Chapter 10

TOOLS AND EQUIPMENT

Chalkboard, overhead projector, transparencies, grease pencil, screen

EVALUATION

The student will complete a teacher-developed test on identifying types of sectional views with 85% accuracy.

DUTY: SECTIONAL VIEWS

TASK: Identify section material symbols

PERFORMANCE OBJECTIVE

Given reference materials, classroom discussion, and drawing exercises, the student will be able to complete a teacher-developed test on identifying sectional symbols for given materials with 85% accuracy.

LEARNING ACTIVITIES

I. Discuss standard symbols for section lining.

II. Demonstrate how to draw section lines.

III. Assign practice exercises for sketching section lines for various materials.

IV. Have students practice exercises for drawing material section lines with instruments.

V. Assign sectional view problems to draw with instruments which include various materials. Discuss the results in class.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, p. 280
Brown. **Drafting for Industry**, p. 182

TOOLS AND EQUIPMENT

Chalkboard, overhead projector, transparency, grease pencil, screen

EVALUATION

The student will complete a teacher-developed test on identifying section symbols for given materials with 85% accuracy.

DUTY: SECTIONAL VIEWS

TASK: Draw sectional views

PERFORMANCE OBJECTIVE

Given paper, drafting tools, a multi-view drawing of an object, and drawing instructions, the student will be able to draw the specified sectional view according to drawing instructions, section conventions, and the instructor's established evaluation standards.

LEARNING ACTIVITIES

I. Discuss each type of sectional view.

II. Demonstrate each type of sectional view with actual objects.

III. Discuss sectioning conventions: webs, spokes, revolved features, and breaks.

IV. Sketch sectional views using the overhead projector.

V. Assign sketching exercises of sectional view problems.

VI. Have students complete drawing problems using proper instruments. Drawing problems should include each of the following sections:
   A. Full section
   B. Half section
   C. Offset section
   D. Revolved section
   E. Removed section
   F. Broken-out section
   G. Assembly section

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing,** Chapter 11, pp. 279-280
Brown. **Drafting for Industry,** Chapter 10

TOOLS AND EQUIPMENT

Overhead projector, screen, transparency, grease pencil, objects from machine shop

EVALUATION

The student will draw the specified sectional view according to drawing instructions, section conventions, and the instructor's established evaluation standards.

DUTY: AUXILIARY VIEWS

TASK: Construct an auxiliary view

PERFORMANCE OBJECTIVE

Given paper, drafting tools, written instructions, and a multi-view drawing of an object which contains a slanted surface, the student will be able to construct (prepare) an auxiliary view of the object (showing the true size and shape of the slanted surface) in accordance with written instructions and evaluation standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Demonstrate the procedure for constructing an auxiliary view.

III. Have students practice using sketching exercises in text.

IV. Assign problems from text for students to draw with instruments. Include:
   A. True shape and size problems
   B. Primary auxiliaries
   C. Partial auxiliaries
   D. Complete auxiliaries
   E. Secondary auxiliaries

V. Review and discuss any difficulties the students may have had in preparing the drawings.

RESOURCES

Spencer and Dygdon. **Basic Technical Drafting,** Chapter 12, pp. 213-229
Brown. **Drafting and Industry,** Chapter 12, pp. 229-248

TOOLS AND EQUIPMENT

Overhead projector, screen, transparency, grease pencil, necessary drawing tools

EVALUATION

The student will construct (prepare) an auxiliary view of the object (showing true size and shape of the slanted surface) in accordance with written instructions and evaluation standards set by the instructor.

DUTY: AXONOMETRIC PROJECTIONS

TASK: Construct isometric drawings

PERFORMANCE OBJECTIVE

Given paper, drafting tools, multi-view drawing of an object, and written instructions, the student will be able to construct (prepare) an isometric drawing of the given object in accordance with written instructions and evaluation standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Demonstrate the procedure for constructing an isometric drawing using an overhead projector or chalkboard.

III. Demonstrate the procedure on a drawing board to small groups.

IV. Have students practice using the sketching exercises.

V. Assign problems from the text for students to draw with instruments. Include:
   A. Slanted surfaces
   B. Circles
   C. Arcs
   D. Irregular curves
   E. Ellipse
   F. Sectional view
   G. Dimensions

VI. Review and discuss any difficulties the students had in preparing the drawings.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 308-316
Brown. **Drafting for Industry**, pp. 192-202

TOOLS AND EQUIPMENT

Overhead projector, screen, transparency, grease pencil, necessary drawing tools

EVALUATION

The student will construct (prepare) an isometric drawing of the given object in accordance with written instructions and evaluation standards set by the instructor.

DUTY: AXONOMETRIC PROJECTIONS

TASK: Construct dimetric and trimetric drawings

PERFORMANCE OBJECTIVE

Given paper, drafting tools, multi-view drawing of an object, and written instructions, the student will be able to construct (prepare) a dimetric drawing and a trimetric drawing of the given object in accordance with written instructions and evaluation standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Demonstrate the procedure for constructing a dimetric drawing and a trimetric drawing using an overhead projector or chalkboard.

III. Demonstrate the procedure on a drawing board to small groups.

IV. Assign problems from text for students to practice drawing true dimetric projections and true trimetric projections.

V. Assign problems from the text for students to practice drawing **approximate** dimetric projections and **approximate** trimetric projections.
NOTE: Both assignments should include: (1) slanted surfaces, (2) circles, (3) arcs, (4) irregular curves, (5) ellipse, and (6) various angles of projection.

VI. Review and discuss any difficulties the students may have had in preparing the drawings.

RESOURCES

Brown. **Drafting for Industry**, pp. 203-207

TOOLS AND EQUIPMENT

Overhead projector, screen, transparency, grease pencil, necessary drawing tools

EVALUATION

The student will construct (prepare) a dimetric drawing and a trimetric drawing of the given object in accordance with written instructions and evaluation standards set by the instructor.

DUTY: OBLIQUE PROJECTIONS

TASK: Construct three types of oblique drawings

PERFORMANCE OBJECTIVE

Given paper, drafting tools, multi-view drawing of an object, and written instructions, the student will be able to construct (prepare) a cavalier, a cabinet, and a general oblique drawing of the given object in accordance with written instructions and evaluation standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Demonstrate the procedure for constructing a cavalier, a cabinet, and a general oblique drawing using an overhead projector or chalkboard.

III. Demonstrate the procedure on a drawing board to small groups.

IV. Have students practice using the sketching exercises.

V. Assign problems from text for students to draw with instruments. Include:
   A. Projections of various angles (ex.: 30°, 45°, 60°)
   B. Inclined surfaces
   C. Circles
   D. Arcs
   E. Irregular curves
   F. Ellipse
   G. Section view
   H. Dimensions

VI. Review and discuss any difficulties the students may have had in preparing the drawings.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing**, pp. 316-321
Brown, **Drafting for Industry**, pp. 208-212

TOOLS AND EQUIPMENT

Overhead projector, screen, transparency, grease pencil, necessary drawing tools

EVALUATION

The student will construct (prepare) a cavalier, a cabinet, and a general oblique drawing of the given object in accordance with written instructions and evaluation standards set by the instructor.

DUTY: PERSPECTIVES

TASK: Define perspective terms

PERFORMANCE OBJECTIVE

Given reference materials and classroom discussion, the student will be able to complete a teacher-developed test on the definition of perspective terms with 85% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Distribute list of terms to students to be defined in notebook.
   A. Station point
   B. Vanishing points
   C. Visual rays
   D. Picture plane
   E. Horizon line
   F. Ground line
   G. Parallel perspective
   H. Angular perspective

III. Point out and discuss terms on a perspective drawing using an overhead projector.

IV. Develop and distribute an unlabeled perspective diagram for students to label.

V. Assign sketching exercise for student practice.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing,** Chapter 16, pp. 321-325
Brown. **Drafting for Industry.** Chapter 11, pp, 212-222

TOOLS AND EQUIPMENT

Overhead projector, screen, transparency, grease pencil

EVALUATION

The student will complete a teacher-developed test on the definition of perspective terms with 85% accuracy.

DUTY: PERSPECTIVES

TASK: Construct a one-point (parallel) perspective and a two-point (angular) perspective.

PERFORMANCE OBJECTIVE

Given paper, drafting tools, multi-view drawing of an object, and written instructions, the student will be able to construct (prepare) a one-point (parallel) perspective and a two-point (angular) perspective of the given object in accordance with written instructions and evaluation standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss the reading assignment.

II. Demonstrate the procedure for constructing a one-point (parallel) perspective and a two-point (angular) perspective.

III. Divide class into small groups and have them practice drawing the perspective.

IV. Have students complete exercises by sketching or with instruments.

V. Assign problems from text for students to solve using instruments. Include the following:
   A. Inclined surfaces
   B. Circles
   C. Arcs
   D. Irregular curves
   E. Ellipse
   F. Section view

VI. Review and discuss any problems the students may have had in preparing the drawings.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing.** Chaper 16, pp. 321-325
Brown. **Drafting for Industry,** Chapter 11, pp. 212-222

TOOLS AND EQUIPMENT

Overhead projector, screen, transparency, grease pencil, drafting instruments

EVALUATION

The student will construct (prepare) a one-point (parallel) and a two-point (angular) perspective of the given object in accordance with written instructions and evaluation standards set by the instructor.

DUTY: MACHINE DRAFTING

TASK: Identify terms from industrial manufacturing processes

PERFORMANCE OBJECTIVE

After classroom instruction and a field trip, the student will be able to complete an instructor-developed test on terms from manufacturing processes with 85% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Create and distribute a list of terms. Example: casting, forging, knurl, counter bore, etc.

III. Create a static display of objects or machine parts produced by various processes.

IV. Conduct a field trip to a local machine shop or manufacturing plant.

V. Assign drawings from the text of parts produced by various processes.

RESOURCES

Brown. **Drafting for Industry**, Chapter 17, pp. 326-352
Spencer and Dygdon. **Basic Technical Drawing**, Chapter 10, pp. 169-193

TOOLS AND EQUIPMENT

Items for a static display of objects or machine parts

EVALUATION

The student will complete an instructor-developed test on terms from manufacturing processes with 85% accuracy.

DUTY: MACHINE DRAFTING

TASK: Prepare detail drawing

PERFORMANCE OBJECTIVE

Given drawing paper, tools, written instructions, and an assembly drawing, the student will be able to prepare a detailed drawing of a specified part in accordance with written instructions and evaluation standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Obtain prints of detail drawings from industry for demonstration.

III. Assign problems for students to sketch detail drawings from isometric drawings.

IV. Assign problems for students to draw detail drawings from isometric drawings with instruments.

V. Assign problems for students to draw detail drawings from an assembly drawing with instruments.

VI. Give students an assembly drawing and all details except one. Instruct the students to draw the missing detail.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing,** pp. 267-305
Brown. **Drafting for Industry,** pp. 397-425

TOOLS AND EQUIPMENT

Necessary drawing tools

EVALUATION

The student will prepare a detailed drawing of a specified part from a given assembly drawing according to written instructions and evaluation standards set by the instructor.

DUTY: MACHINE DRAFTING

TASK: Prepare an assembly drawing

PERFORMANCE OBJECTIVE

Given drawing paper, tools, written instructions, and detail drawings, the student will be able to prepare an assembly drawing and a parts list of the details in accordance with written instructions and evaluation standards set by the instructor.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Obtain assembly drawings from industry to use for demonstration.

III. Distribute excercise sheets for the students to practice completing a parts list.

IV. Instruct students to draw an assembly with a parts list when given isometric drawings of the parts.

V. Instruct students to draw an assembly with a parts list when given a detailed drawing of each part.

RESOURCES

Spencer and Dygdon. **Basic Technical Drawing.**
Brown. **Drafting for Industry,** pp. 397-425

TOOLS AND EQUIPMENT

Necessary drawing tools

EVALUATION

The student will prepare an assembly drawing and a parts list of the given detail drawings in accordance with written instructions and evaluation standards set by the instructor.

DUTY: MACHINE DRAFTING

TASK: Describe fasteners commonly used in machinery

PERFORMANCE OBJECTIVE

Given classroom instruction and discussion, the student will be able to describe the fasteners commonly used in machinery with 85% accuracy.

LEARNING ACTIVITIES

I. Lecture on the history of fasteners as used in machinery.

II. Pass around samples of various machine fasteners for students to examine.

III. Lead a class discussion on the various types and applications of machine fasteners.

IV. Lecture on the features of threaded fasteners.

V. Lecture on the helix as the basis of threaded fasteners, the thread forms commonly used, and the standards used when specifying, manufacturing, and applying various threaded fasteners.

RESOURCES

French, et al. **Mechanical Drawing,** 8th ed., Chapter 10

TOOLS AND EQUIPMENT

Pencil, paper, chalkboard, samples of machine fasteners

EVALUATION

The student will describe the fasteners commonly used in machinery with 85% accuracy.

DUTY: MACHINE DRAFTING

TASK: Prepare drawings of fasteners commonly used in machinery

PERFORMANCE OBJECTIVE

Given lecture, demonstration, and equipment, the student will be able to draw fasteners commonly used in machinery, accurate to ± 1/32".

LEARNING ACTIVITIES

I. Explain and demonstrate the method used in constructing a helix and the following thread representations:
   A. Detailed
   B. Schematic
   C. Simplified

II. Explain and demonstrate how to draw rivets, keys, and setscrews.

III. After each demonstration, have students draw examples of each.

IV. Review, discuss, and demonstrate any difficulties the students may have had in preparing the drawings.

V. Have students continue practicing the drawings they had difficulty with.

RESOURCES

French, et al. **Mechanical Drawing**, 8th ed., Chapter 10
Spence. **Drafting Technology and Practice**, Chapter 26

TOOLS AND EQUIPMENT

Drawing paper, drafting tape, drawing board, T-square, triangles, set of case instruments, pencil or leadholder, eraser, scales, pencil pointer, cloth, chalkboard

EVALUATION

The student will draw fasteners commonly used in machinery accurate to ± 1/32".

DUTY: MACHINE DRAFTING

TASK: Define terms related to gears

PERFORMANCE OBJECTIVE

Given reading assignments and classroom discussion, the student will be able to identify and define in writing the basic terms as they apply to gear design and drawing with 70% accuracy.

LEARNING ACTIVITIES

I. Define and describe gears, the different types of gears, and how they are used.

II. Define, describe, and illustrate the terms as they apply to:
   A. Spur gears
   B. Racks
   C. Bevel gears
   D. Worms

RESOURCES

Giachino and Beukema. **Drafting and Graphics**, pp. 337-358
Gresecke, et al. **Technical Drawing**, pp. 595-604
Handouts

TOOLS AND EQUIPMENT

Chalkboard, chalk, overhead projector, screen, grease pencil

EVALUATION

The students will identify and define in writing the basic terms as they apply to gears with 70% accuracy.

GEARS

SPUR: Cylindrical with teeth straight across face of gear and parallel to shaft axis. Used on parallel shafts.

RACK: A rack has straight teeth on a straight bar. Used to transfer circular motion to straight-line motion.

INTERNAL (RING): A "spur" with the straight teeth on the inside surface rather than the external surface.

BEVEL: Conical shaped with either straight or curved teeth on the surface. Used to transfer power or motion at an angle. (Understood to be 90° unless otherwise specified.)

ANGLE GEARS: Having shafts that intersect at other than 90°.

MITER GEARS: Bevel gears in which both driver and driven shafts have the same number of teeth and are at 90° to each other.

HELICAL SPIRAL CROSS AXIS: Cylindrical with teeth cut at an angle to the shaft axis. Used to connect non-intersecting shafts at an angle to each other. Usually run more smoothly than spur gears.

WORMS: Gears similar to screw thread. They may have single, double, triple, or quadruple lead.

WORMGEAR: Run off of "worms" and are cylindrical with teeth which match those of the "worm." Used to transmit power or motion when high-ratio speed reduction is necessary. The two shafts are at an angle to each other.

PINION (DRIVER): A small gear that provides the power and runs the larger gear.

ROLERCHAIN SPROCKETS: A rolerchain connects two sprockets on parallel shafts. Sprockets are gears with teeth, parallel to the shaft axis (double sprockets are used with two chains when double power is involved).

DUTY: MACHINE DRAFTING

TASK: Describe the procedure for drawing a spur gear

PERFORMANCE OBJECTIVE

Given the reading assignments and classroom discussion, the student will be able to describe in writing the procedures for preparing a drawing of a spur gear with 100% accuracy.

LEARNING ACTIVITIES

I. Describe how the pitch circle is drawn and how the outside circle and the root circle are based on the pitch circle.

II. Describe how the radial lines are based on the number of teeth on the gear (N = P x D).

III. Describe how the pressure angle is used in representing the tooth thickness by establishing the base circle.

IV. Describe how the involute is simulated in drawing the face of the gear tooth.

RESOURCES

Geachino and Beukema. **Drafting and Graphics**, pp. 341-345

TOOLS AND EQUIPMENT

Chalkboard, chalk, overhead projector, screen, grease pencil

EVALUATION

The student will describe in writing the procedures for drawing a spur gear with 100% accuracy.

SPUR GEARS

OUTSIDE DIAMETER: Diameter of the circle around the extreme outer edges of the teeth.

PITCH CIRCLE: Theoretical circle on which the teeth of the mating gears mesh.

PITCH DIAMETER: Diameter of the pitch circle.

ROOT DIAMETER: Diameter of the root circle.

DIAMETRAL PITCH (DP): Inidicates tooth sizes. It is the ratio of the number of teeth in the gear to each inch of pitch diameter.

CIRCULAR PITCH: Distance between corresponding points on adjacent teeth measured along the pitch circle.

WHOLE DEPTH: Distance from "outside diameter" to "root diameter."

ADDENDUM: Distance from "outside diameter" to "pitch circle."

DEDENDUM: Distance from "root diameter" to "pitch circle (equals addendum plus working clearance).

WORKING DEPTH: Depth of engagement of two gears (2 x addendum).

WORKING CLEARANCE: Distance from "working depth" to root circle. (The space between the top of one tooth and the root circle of the mating gear when in mesh.)

CIRCULAR THICKNESS: Length of arc between the two sides of a gear tooth measured along the pitch circle.

CHORDAL THICKNESS: Thickness of the gear measured along a chord at the pitch circle.

CHORDAL ADDENDUM: Distance from a line representing "chordal thickness" to the "outside diameter."

CENTER DISTANCE: Distance from the center of one shaft to the center of another shaft.

BACKLASH: Play between mating teeth measured between non-driving surfaces.

PRESSURE ANGLE (14½° or 20°): The angle at which pressure from the tooth of one gear is passed on to the tooth of another gear. (This angle determines the shape of or form of the tooth and also determines the base circle).

VELOCITY OR FEET PER MINUTE: Distance that any point or the "pitch circle" will travel in a given period of time.

BASE CIRCLE: Circle from which the involute tooth profile is formed.

GEAR RATIO: Number of teeth on the gear divided by the number of teeth on the pinion (ratio of the two "pitch diameters").

FACE OF TOOTH: Tooth surface from the "pitch circle" to the "outside circle."

FLANK OF TOOTH: Tooth surface from the "pitch circle" to the "root circle."

DUTY: MACHINE DRAFTING

TASK: Describe the procedures for drawing a rack and pinion

PERFORMANCE OBJECTIVE

Given the reading assignments and classroom discussion, the student will be able to describe in writing the procedures for preparing a drawing of a rack and pinion with 100% accuracy.

LEARNING ACTIVITIES

I. Review the procedures for drawing a spur gear.

II. Describe the procedures for drawing the tooth profile of a rack.
   A. Explain how circular pitch is converted to linear pitch.
   B. Explain how the pressure angle is used to produce the tooth profile.
   C. Demonstrate the approximation of the basic rack profile.

RESOURCES

Geachino and Beukema. **Drafting and Graphics**, pp. 346-348

TOOLS AND EQUIPMENT

Chalkboard, chalk, overhead projector, screen, grease pencil

EVALUATION

The student will describe in writing the procedures for drawing a rack and pinion system with 100% accuracy.

RACK AND PINION

RACK: A type of spur gear used to transfer circular motion into straight-line motion. A rack is a straight bar with teeth instead of a cylindrical gear.

PINION: A small gear which meshes with a main gear and provides the power to run the gear train (the driver gear).

A rack is essentially a spur gear with teeth spaced along a straight line and designed for straight line motion.

The linear pitch of the rack must be equal to the circular pitch of the mating gear (pinion) if they are to mesh properly.

DUTY: MACHINE DRAFTING

TASK: Describe the procedure for drawing a pair of bevel gears

PERFORMANCE OBJECTIVE

Given the reading assignments and classroom discussion, the student will be able to describe in writing the procedures for preparing a drawing of a bevel gear with 90% accuracy.

LEARNING ACTIVITIES

I. Explain that the tooth form for bevel gears is the same as for spur gears.

II. Explain the differences in a bevel gear and a spur gear:
   A. Pitch diameter
   B. Pitch angle
   C. Cone distance
   D. Face and face angle
   E. Mounting distance
   F. Root angle
   G. Crown backing
   H. Crown height

III. Demonstrate the procedure for drawing a pair of bevel gears and show the student how to use the formulas that are used in making calculations.

RESOURCES

Geachino and Beukema. **Drafting and Graphics**, pp. 348-350
Handout

TOOLS AND EQUIPMENT

Chalkboard, chalk, overhead projector, screen, grease pencil

EVALUATION

The student will make a procedural checklist of the step-by-step methods for drawing a pair of bevel gears with 90% accuracy.

BEVEL AND MITER GEARS

Bevel and miter gears use the same involute tooth forms as spur gears except that the teeth are tapered toward the apex of the cone.

PITCH DIAMETER: Diameter of the pitch circle measured at the base of the cone.

PITCH ANGLE: Angle between an element of the pitch cone and its axis.

CONE DISTANCE: Slant length of the pitch cone.

FACE: Length of the tooth.

FACE ANGLE: Angle between an element of the face cone and its axis.

MOUNTING DISTANCE: Distance from the pitch apex to a surface of the gears used for locating in assembly.

ROOT ANGLE: Angle between an element of the root cone and its axis.

CROWN BACKING: Distance between the rear of the hub and outer tip of the gear tooth.

CROWN HEIGHT: Distance between the apex and the outer tip of the gear tooth measured parallel to the axis of the gear.

Procedure for Drawing a Pair of Involute Bevel Gears

1. Draw the axis of the two bevel gears perpendicular (or shaft angle) to each other.
2. Lay out the pitch angle.
3. Lay out the cone distance.
4. Lay out the pitch diameter.
5. Lay out the addendum and dedendum. (Measured at the large end and perpendicular to the pitch angle line.)
6. Using construction lines, draw lines from the pitch point to the addendum and dedendum. (This completes the root and face angles.)
7. Information concerning the bore, hub diameter, other casting information, and mounting distances must be obtained to complete the drawing.

DUTY: MACHINE DRAFTING

TASK: Describe the value of a gear train system

PERFORMANCE OBJECTIVE

Given the reading assignments and classroom discussions, the student will be able to describe in writing the speed-reduction (increase) factor with 90% accuracy.

LEARNING ACTIVITIES

I. Describe and analyze the procedure for calculating the RPM's of a simple gear train.

II. Discuss and demonstrate the schematic representations of gears.

III. Discuss and explain splines as a means of connecting shafts and preventing relative motion.

RESOURCES

Geachino and Beukema. **Drafting and Graphics,** pp. 354-356

TOOLS AND EQUIPMENT

Chalkboard, chalk, overhead projector, screen, grease pencil

EVALUATION

The student will complete a series of problems on RPM calculations and identifying schematic representations of gears with 90% accuracy.

DUTY: MACHINE DRAFTING

TASK: Describe the basic welding processes and their common applications

PERFORMANCE OBJECTIVE

Given lecture and resource materials, the student will be able to describe the eight basic welding processes and their common applications with 85% accuracy.

LEARNING ACTIVITIES

I. Discuss reading assignment.

II. Describe the basic welding processes for metals, their history, and terminology.

III. Explain the variations of the basic welding processes to include fusion, gas, arc, thermit, shielded arc, MIG, TIG, and resistance welding.

IV. Explain the five basic welded joints.

RESOURCES

French, et al. **Mechanical Drawing,** 8th ed., Chapter 17

TOOLS AND EQUIPMENT

Pencil, paper, chalkboard

EVALUATION

Student will describe the eight welding processes and the five basic welded joints with 85% accuracy.

DUTY: MACHINE DRAFTING

TASK: Prepare welding drawings

PERFORMANCE OBJECTIVE

Given lecture, demonstration, and equipment, the student will be able to prepare five welding drawings using appropriate welding symbols with 85% accuracy.

LEARNING ACTIVITIES

I. Explain and display the basic types of welds: square, single-V, double-V, single-U, etc.

II. Explain the symbols used to indicate the types of welds.

III. Discuss the reading assignment.

IV. Have students practice drawing the types of welded joints and the symbols used to specify them.

RESOURCES

French, et al. **Mechanical Drawing**, 8th ed., Chapter 17

TOOLS AND EQUIPMENT

Pencil, eraser, triangles, T-square, drawing board, case instruments, pencil, pointer, cloth

EVALUATION

Student will prepare five welding drawings using appropriate welding symbols with 85% accuracy.

DUTY: MACHINE DRAFTING

TASK: Define terms pertaining to descriptive geometry

PERFORMANCE OBJECTIVE

Given the necessary equipment, reading assignment, and class discussion, the student will be able to describe lines, edges, and surfaces from forshortened views with 70% accuracy.

LEARNING ACTIVITIES

I. Explain and demonstrate the procedure for determining the following:
   A. True length of a line and from two forshortened adjacent views
   B. Point view of an oblique line

II. Explain and demonstrate the procedure for:
   A. Constructing the edge view of a plane
   B. Finding the true size of an inclined and oblique plane figure

III. Distribute handout and demonstrate how to solve for the true length and true sizes.

RESOURCES

Geachino and Beukema. **Drafting and Graphics**, pp. 580-585
Handout

TOOLS AND EQUIPMENT

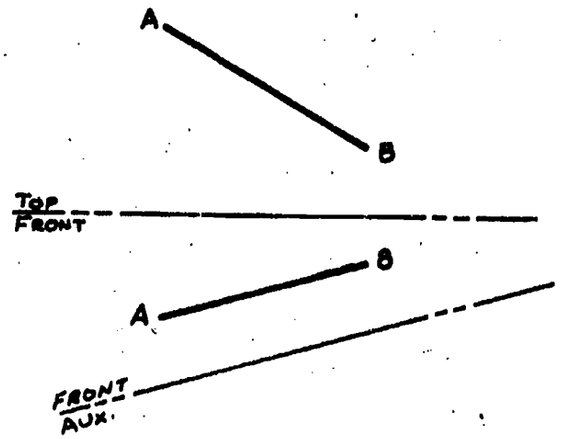
Chalkboard, chalk, overhead projector, screen, grease pencil, handout

EVALUATION

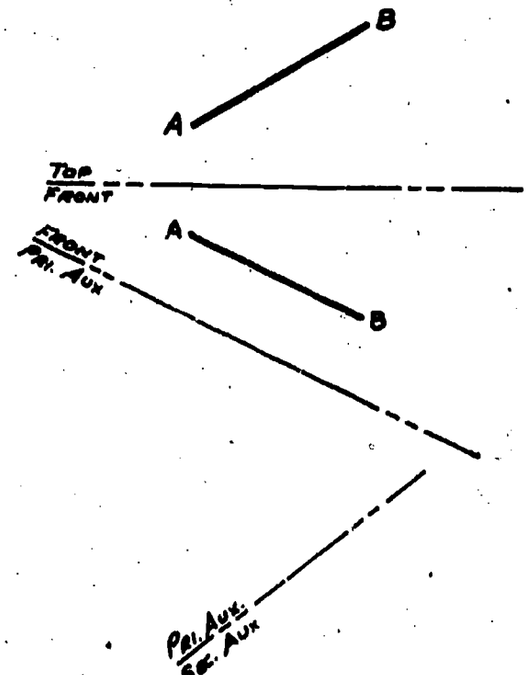
The student will complete the handout and describe lines, edges, and surfaces from forshortened views with 70% accuracy.

GIVEN : TWO-VIEW ORTHOGRAPHIC

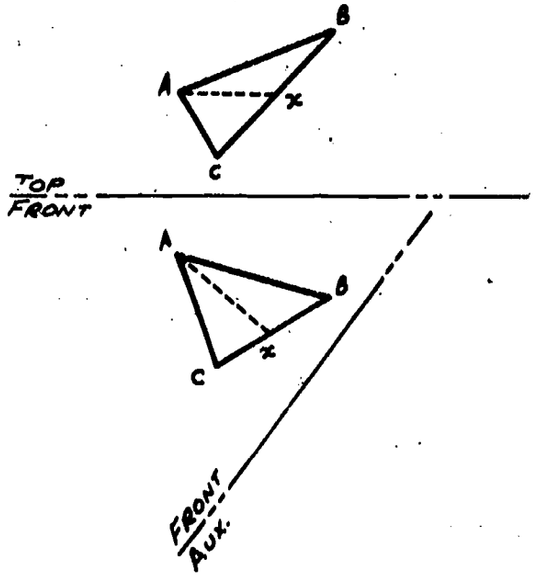
REQUIRED : PROVIDE THE PATTERN



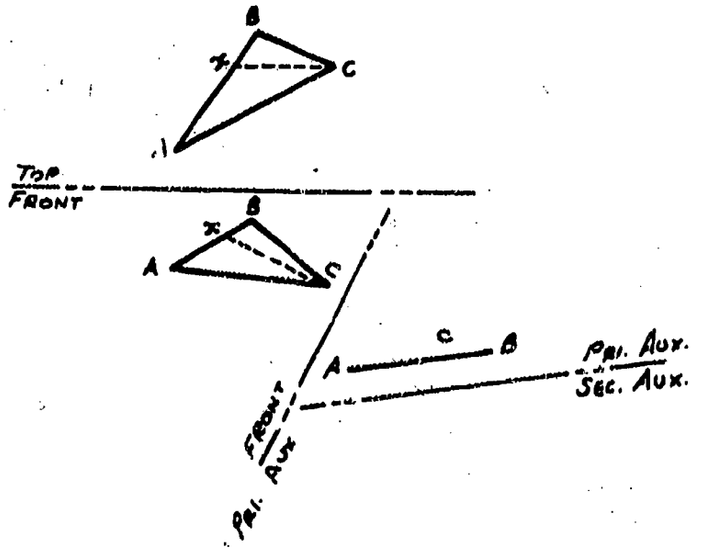
FIND THE TRUE LENGTH OF LINE AB.



DETERMINE THE POINT VIEW OF LINE AB.



CONSTRUCT AN EDGE VIEW OF A PLANE.



FIND THE TRUE SIZE AND SHAPE OF A PLANE SURFACE.

DEVELOPMENTS & INTERSECTIONS	NAME	SCALE DATE	A-

87

88

89

DUTY: MACHINE DRAFTING

TASK: Define the classification of surfaces

PERFORMANCE OBJECTIVE

Given the reading assignments and classroom discussions, the student will be able to identify the classification of surfaces with 70% accuracy.

LEARNING ACTIVITIES

I. Define and describe:
   A. Surfaces
   B. Ruled surfaces
   C. Planes
   D. Single-curved surfaces
   E. Double-curved surfaces
   F. Developments and patterns

II. Describe and demonstrate the process of pattern development.

RESOURCES

Geachino and Beukema. **Drafting and Graphics**, pp. 595-598
Gresecke, et al. **Technical Drawing**, pp. 567-570

TOOLS AND EQUIPMENT

Chalkboard, chalk, overhead projector, screen, grease pencil

EVALUATION

The student will define in writing the classification of surfaces and demonstrate a working knowledge of pattern development (by labeling a pattern) with 70% accuracy.

90

DUTY: MACHINE DRAFTING

TASK: Develop patterns for plane and single-curved surfaces

PERFORMANCE OBJECTIVE

Given the necessary tools, equipment, reading assignments, a classroom discussion, and demonstrations, the student will be able to develop patterns with 70% accuracy.

LEARNING ACTIVITIES

I. Explain and demonstrate the procedure for developing the patterns for truncated pieces:
   A. Truncated right rectangular pipe
   B. Truncated right hexagonal pipe
   C. Truncated right cylinder

II. Explain and demonstrate the procedure for developing patterns for intersecting pieces:
   A. 90° T-joint with like diameters
   B. 90° T- joint with unlike diameters
   C. Circular pipe intersecting a plane at an angle
   D. Circular pipe intersecting at an angle
   E. Square pipe intersecting at a 90° angle.
   F. Four-piece elbow

III. Explain and demonstrate the procedure for developing patterns for transition pieces:
   A. Twin elbows
   B. Truncated right pyramid
   C. Truncated oblique pyramid
   D. Truncated rectangular oblique pyramid
   E. Right cone
   F. Truncated right cone
   G. Oblique cone
   H. Oblique round-to-round transition (paralleled axis)
   I. Oblique round-to-round transition (oblique axis)
   J. Rectangular to round transition

RESOURCES

Geachino and Beukema. **Drafting and Graphics**, pp. 597-613
Handouts

TOOLS AND EQUIPMENT

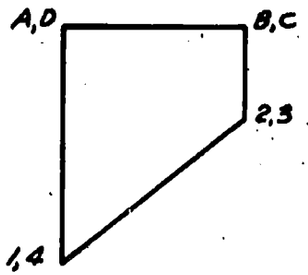
Chalkboard, chalk, overhead projector, screen, grease pencil, handouts

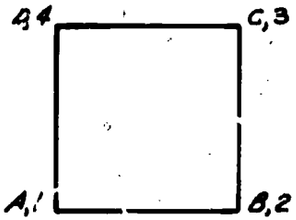
EVALUATION

The student will complete intersection and development problems as assigned by the instructor with 70% accuracy.

GIVEN : TWO-VIEW ORTHOGRAPHICS.

REQUIRED : PROVIDE THE PATTERN

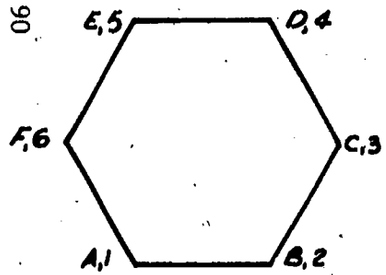


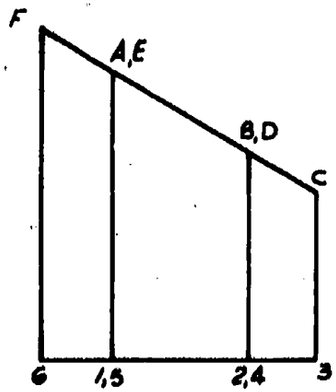


TRUNCATED RT. RECTANGULAR PIPE

TRUNCATED RT HEXAGONAL PIPE

90





DEVELOPMENTS & INTERSECTIONS

NAME

SCALE

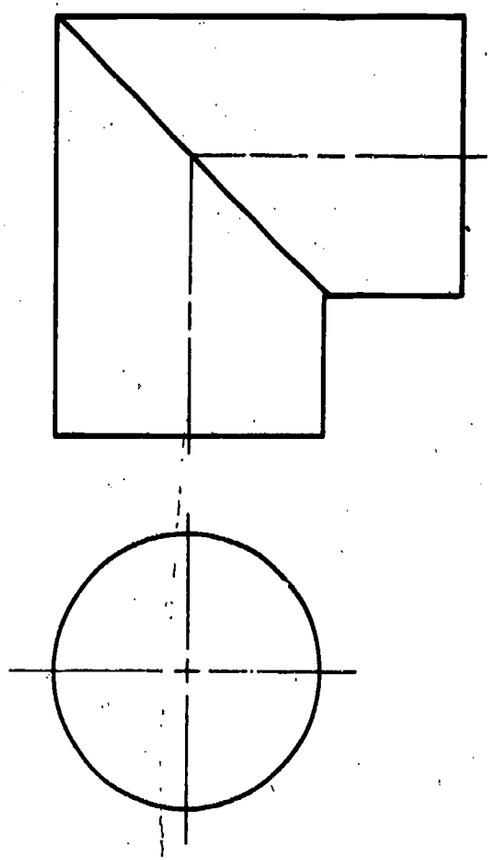
DATE

A-

JDH '89

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERN FOR A TRUNCATED RT. CYLINDER



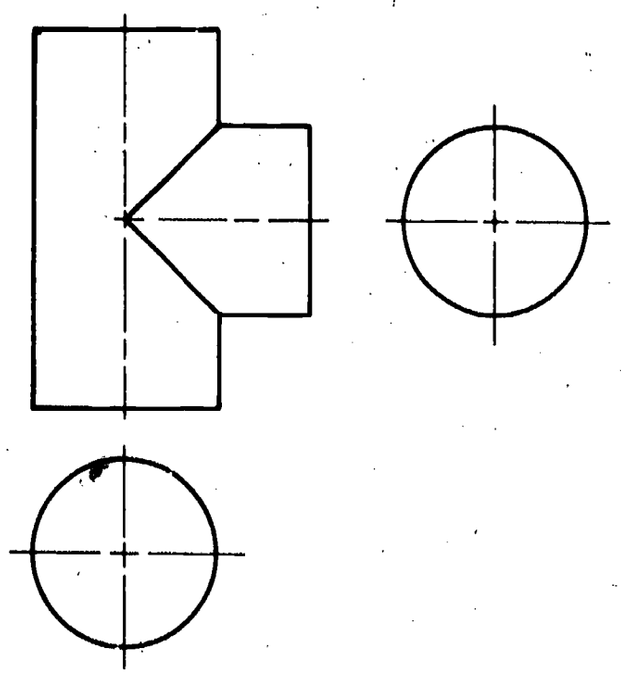
91

DEVELOPMENTS & INTERSECTIONS	NAME	SCALE DATE	A-

JNH '89

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERNS FOR A 90° "T-JOINT" WITH LIKE DIAMETERS.



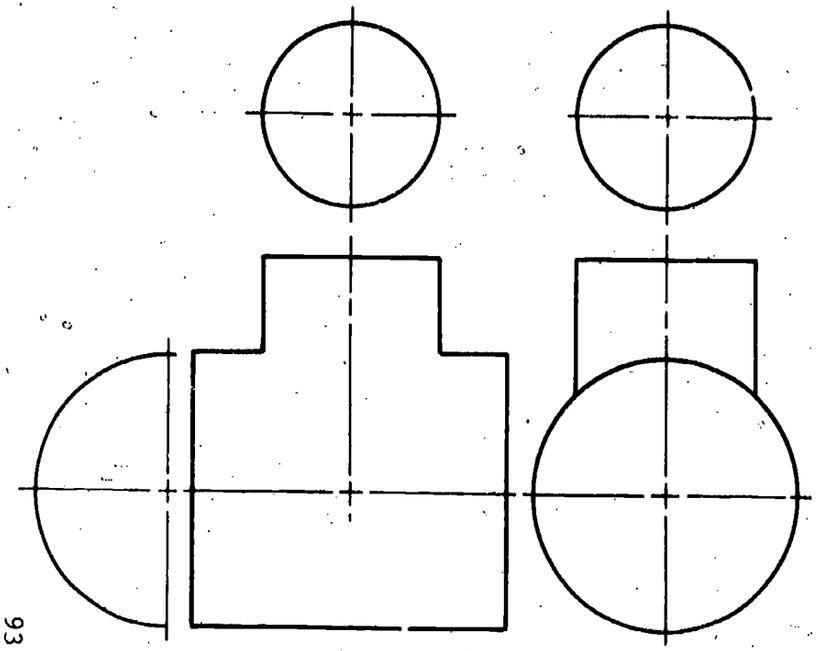
92

DEVELOPMENTS & INTERSECTIONS	NAME	SCALE DATE	A-

JAN '69

GIVEN: TWO-VIEW ORTHOGRAPHIC

REQUIRED: PROVIDE THE PATTERNS FOR A 90° "T-JOINT" WITH UNLIKE DIAMETERS.

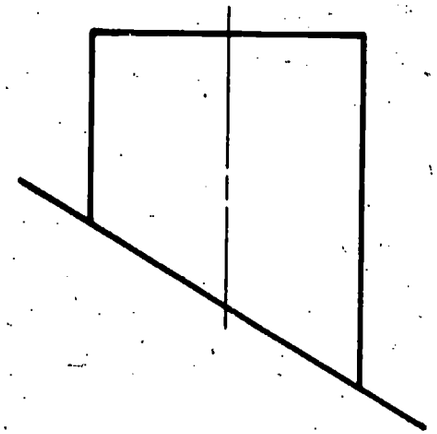


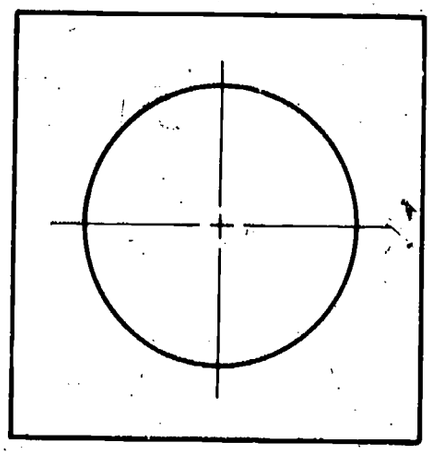
93

DEVELOPMENTS & INTERSECTIONS	NAME	SCALE	A-
		DATE	

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERN FOR A CIRCULAR PIPE AND A PLANE.





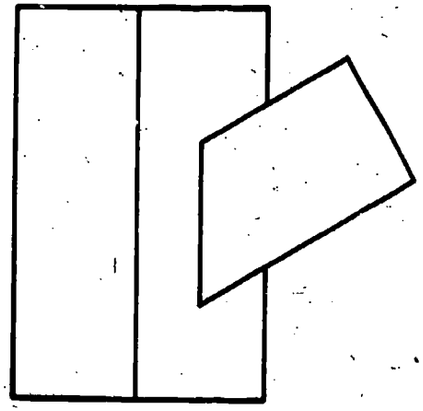
94

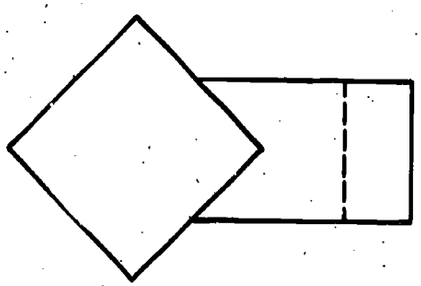
DEVELOPMENTS & INTERSECTIONS	NAME	SCALE	A-
		DATE	

.IDH '89

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERNS FOR TWO SQUARE PIPE INTERSECTING AT AN ANGLL OF 30°.



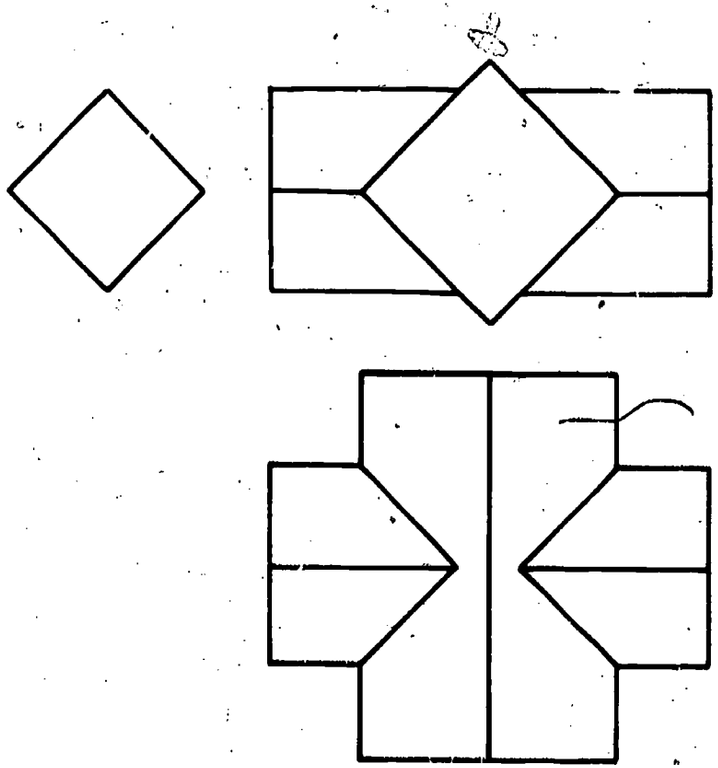


95

DEVELOPMENTS & INTERSECTIONS		SCALE	A-
		DATE	

GIVEN : TWO-VIEW ORTHOGRAPHIC

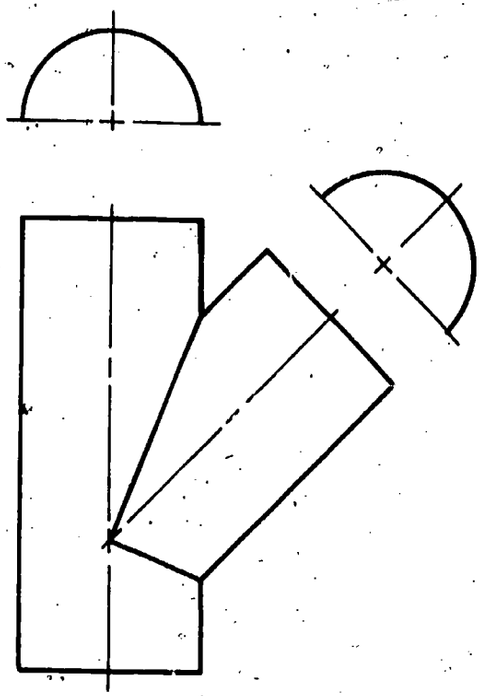
REQUIRED : PROVIDE THE PATTERNS FOR TWO SQUARE DUCT INTERSECTING AT 90°.



DEVELOPMENTS & INTERSECTIONS		SCALE	A-
		DATE	

GIVEN: TWO-VIEW ORTHOGRAPHIC

REQUIRED: PROVIDE THE PATTERNS FOR TWO PIPE OF LIKE DIA. INTERSECTING AT 45°.



97

DEVELOPMENTS & INTERSECTIONS

NAME

SCALE

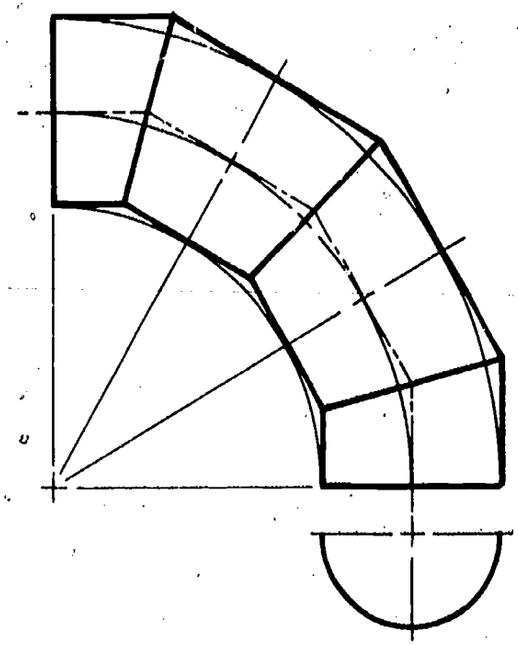
DATE

A-

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERNS FOR A FOUR PIECE ELBOW.

86



DEVELOPMENTS & INTERSECTIONS

NAME

SCALE

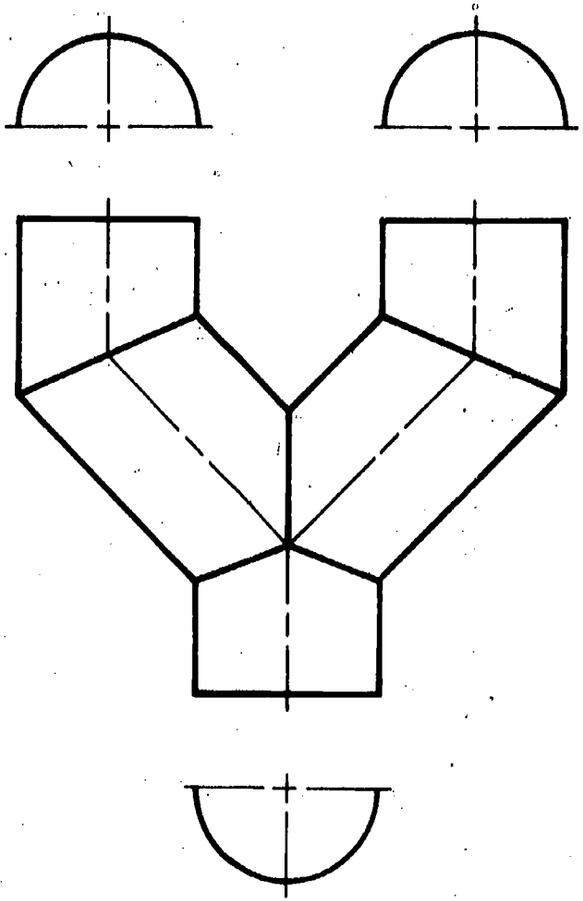
DATE

A-

JDH '89

GIVEN · FOUR-VIEW ORTHOGRAPHIC

REQUIRED · PROVIDE THE PATTERNS FOR A TWIN ELBOW.



66

DEVELOPMENTS & INTERSECTIONS

NAME

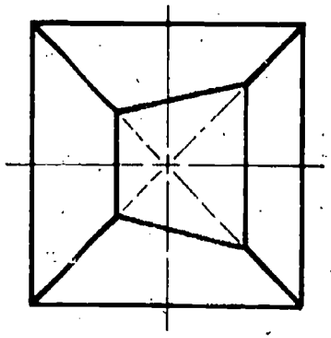
SCALE

DATE

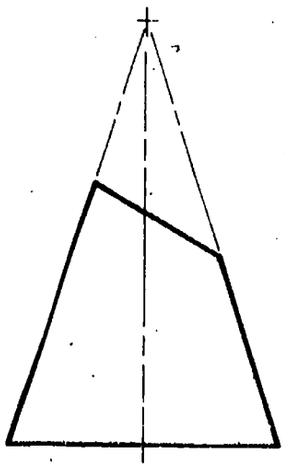
A-

GIVEN: TWO-VIEW ORTHOGRAPHIC

REQUIRED: PROVIDE THE PATTERN TRUNCATED RT. PYRAMID.



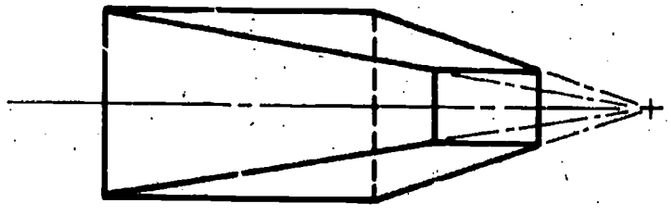
100



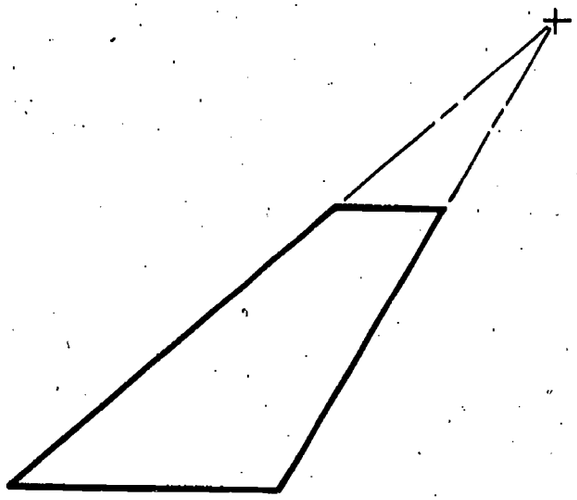
DEVELOPMENTS & INTERSECTIONS	NAME	SCALE	A-
		DATE	

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERN TRUNCATED OBLIQUE PYRAMID.



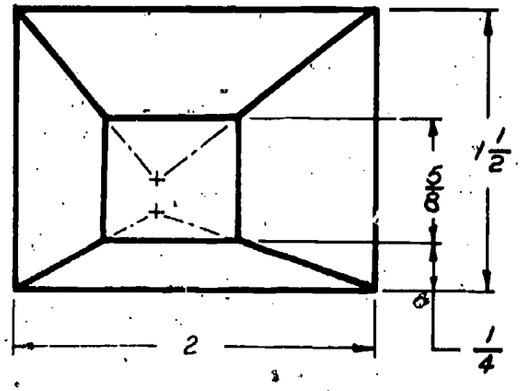
101

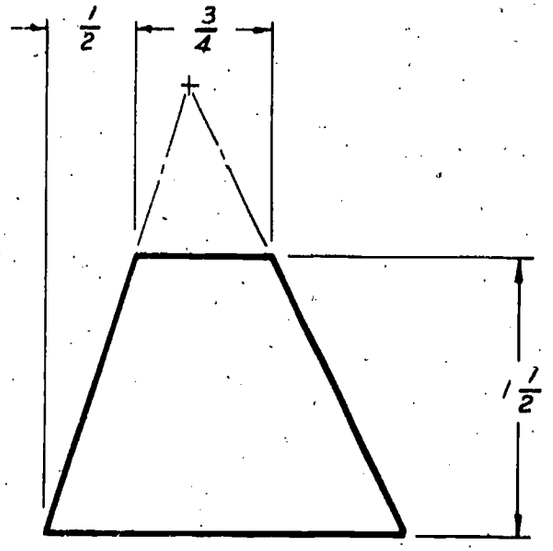


DEVELOPMENTS & INTERSECTIONS	NAME	SCALE	A-
		DATE	

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED: PROVIDE THE PATTERN - TRUNCATED RECTANGULAR OBLIQUE TRANSITION.





102

DEVELOPMENTS & INTERSECTIONS

NAME

SCALE

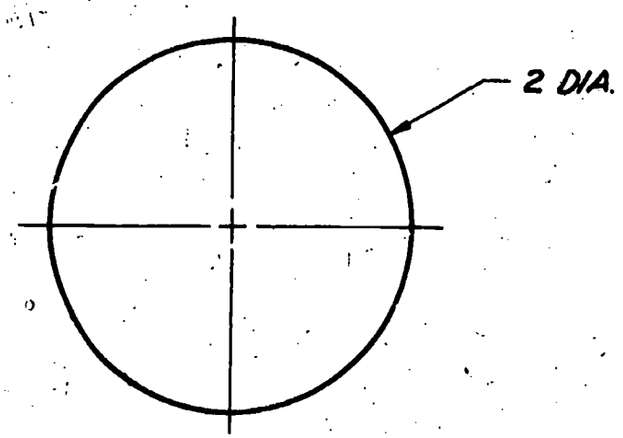
DATE

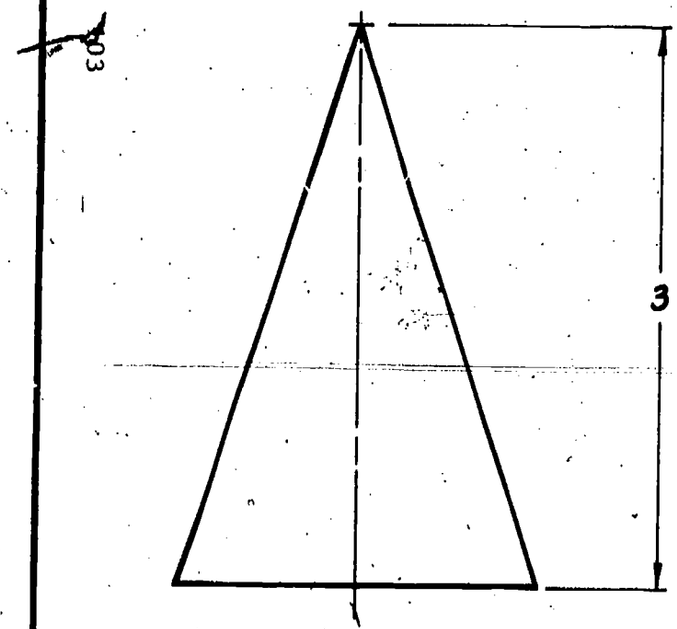
A-

JDH '83

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERN -- RT. CONE

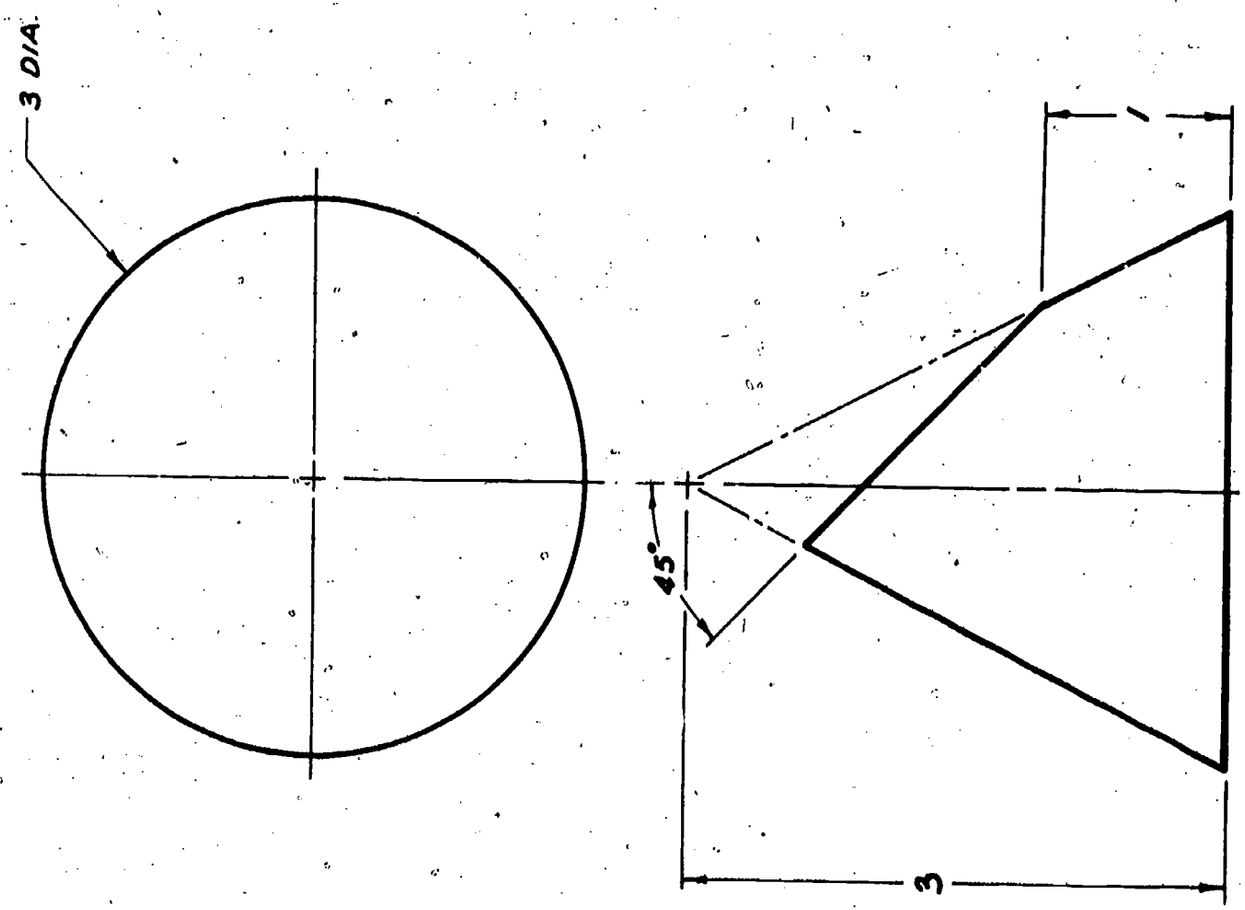




DEVELOPMENTS & INTERSECTIONS	NAME	SCALE DATE	A-

GIVEN : TWO-VIEW ORTHOGRAPHIC - TRUNCATED RT. CONE.

REQUIRED : PROVIDE THE PATTERN AND THE COMPLETED TOP VIEW

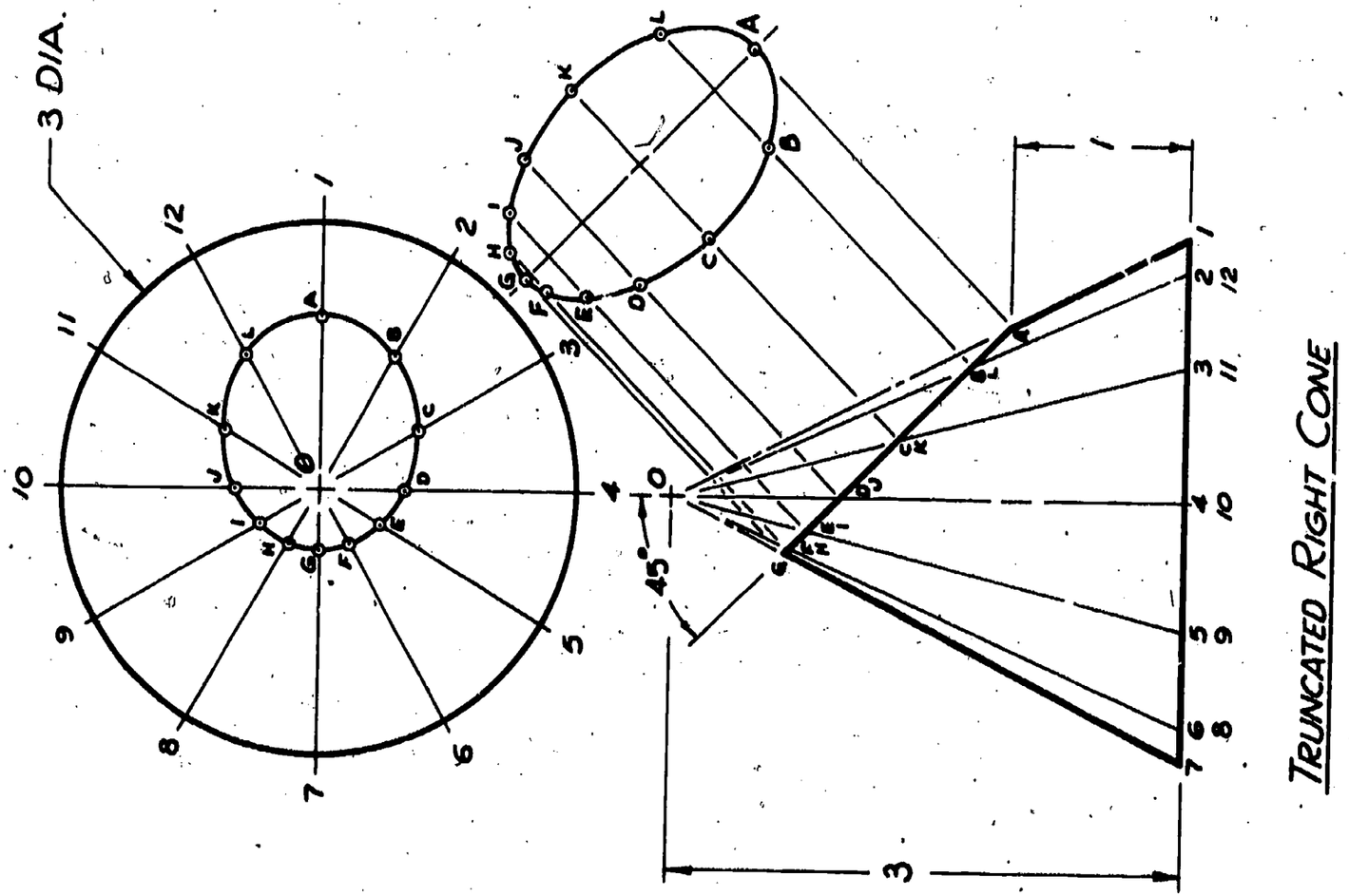


104

DEVELOPMENTS & INTERSECTIONS	NAME	SCALE DATE	A-

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERN - TRUNCATED RT. CONE.



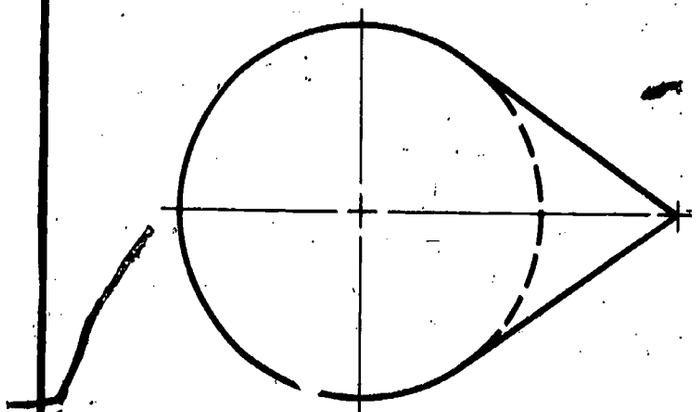
105

DEVELOPMENTS & INTERSECTIONS	NAME	SCALE:	A-
		DATE:	

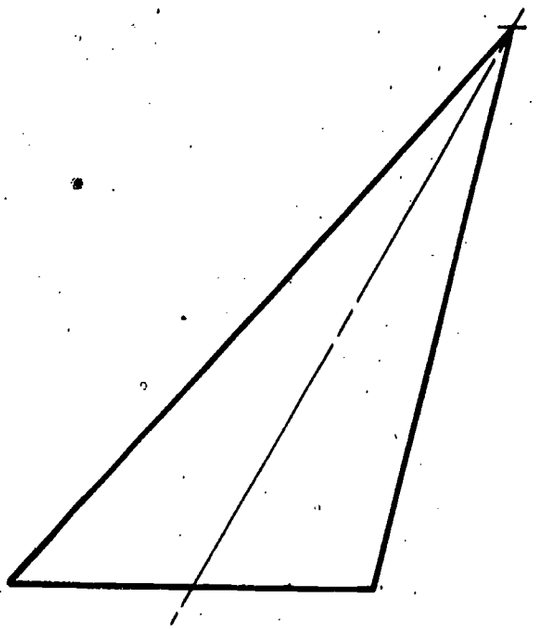
JDH '89

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERN - OBLIQUE CONE.



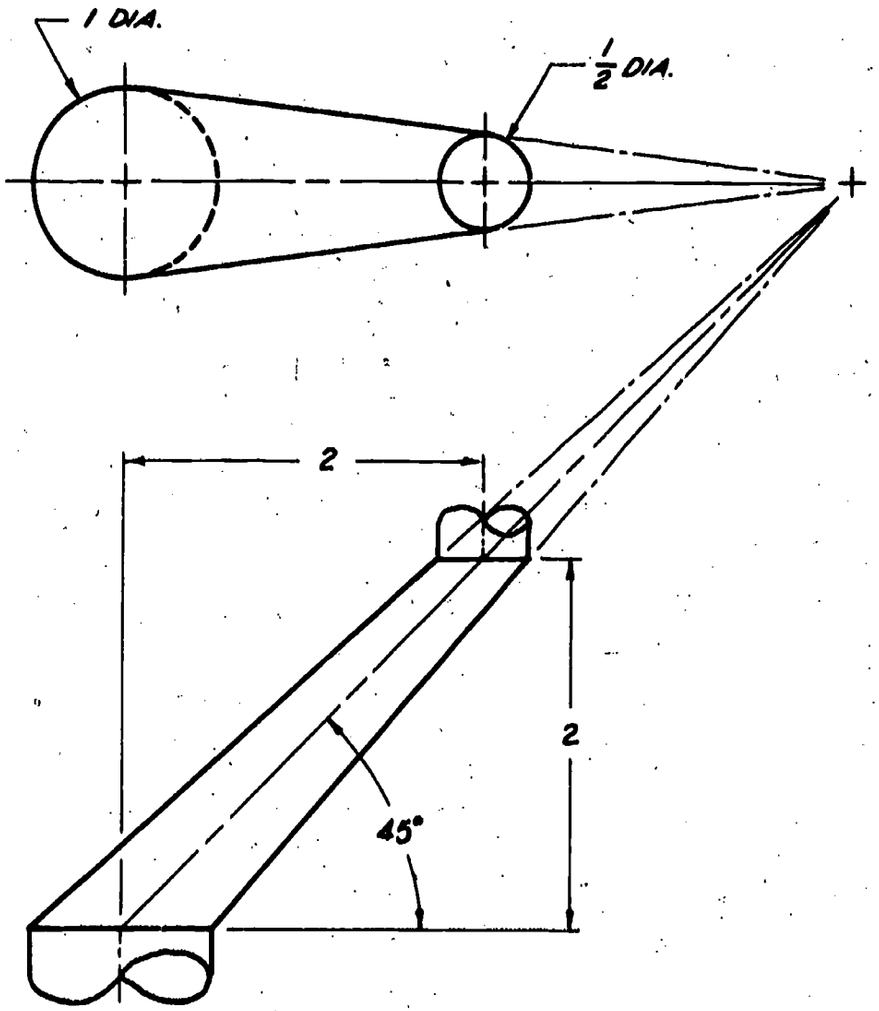
106



DEVELOPMENTS & INTERSECTIONS	NAME	SCALE	A-
		DATE	

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERN - OBLIQUE ROUND-TO-ROUND (PARALLEL AXIS).



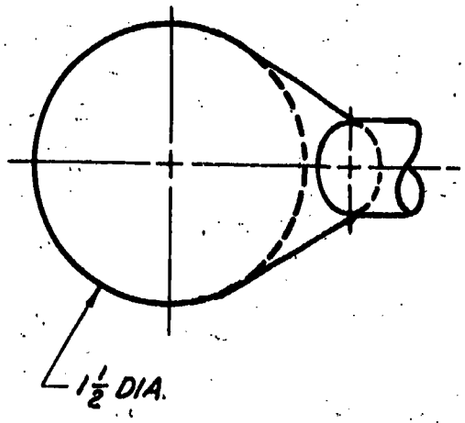
107

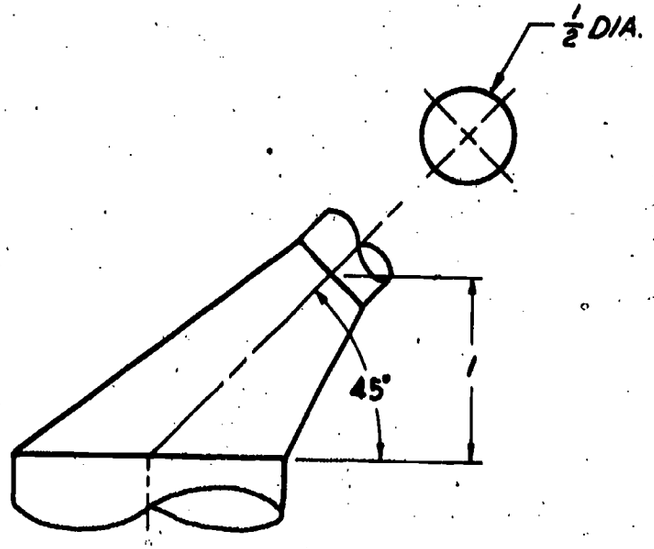
DEVELOPMENTS & INTERSECTIONS	NAME	SCALE:	A-
		DATE	

JDH '89

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED: PROVIDE THE PATTERN-OBLIQUE ROUND-TO-ROUND TRANSITION (OBLIQUE AXIS)





108

DEVELOPMENTS & INTERSECTIONS

NAME

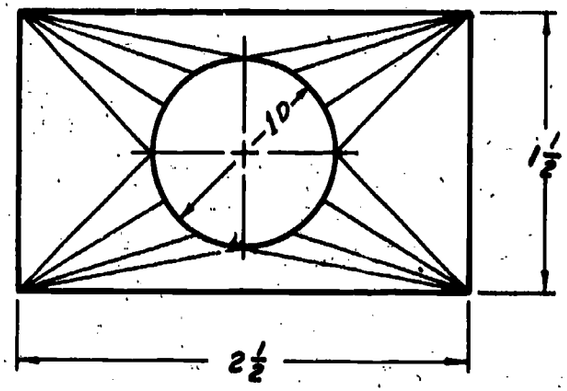
SCALE

DATE

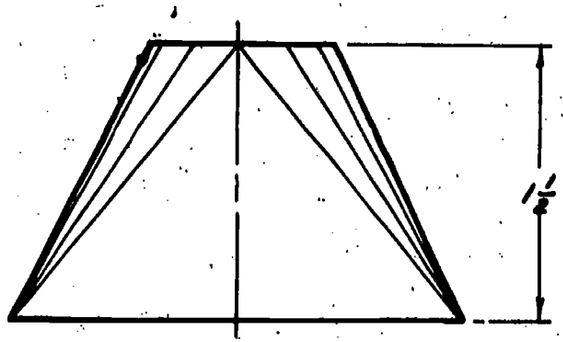
A-

GIVEN : TWO-VIEW ORTHOGRAPHIC

REQUIRED : PROVIDE THE PATTERN - RECTANGULAR TO ROUND TRANSITION.



109



DEVELOPMENTS & INTERSECTIONS	NAME	SCALE	A-
		DATE	

JDH '89

BIBLIOGRAPHY

Brown, Walter C. **Drafting for Industry.** Chicago: The Goodheart-Willcox Co. Inc., 1978.

Encyclopedia Americana, New York: Americana Corporation, current edition.

French, Thomas E., et al. **Mechanical Drawing,** 8th ed. New York: McGraw-Hill Book Co., 1974.

French, Thomas E. and Svenson, Carl L. **Mechanical Drawing,** 7th ed. New York: McGraw-Hill Book Co., 1966.

French, Thomas E. and Vierck, Charles. **Engineering Drawing and Graphic Technology,** 12th ed. New York: McGraw-Hill Book Co., 1972.

Geachino, J. W. and Beukema, H. J. **Drafting and Graphics.** Chicago: American Technical Society, 1969.

Giesecke, F. E., et al. **Technical Drawing.** New York: Macmillan Publishing Company, Inc., 1974.

Goetsch, David L. **The CAD/CAM Workbook.** Cincinnati, Ohio: South-Western Publishing Co., 1983.

Job Seeking: How and Where. Columbia, S.C.: South Carolina Department of Education, 1982.

South Carolina Occupational Information Service (SCOIS). Columbia, S.C.: South Carolina Employment Security Commission, 1982.

Spence, William P. **Drafting Technology and Practice.** Peoria, Ill.: Charles A. Bennett Co., Inc., 1973.

Spencer, Henry C. and Dygdon, John Thomas. **Basic Technical Drawing.** New York: Macmillan Publishing Co., Inc., 1974.

World Book Encyclopedia. Chicago: Field Enterprises Educational Corporation, current edition.

Wright, Lawrence S. **Drafting,** 1st ed. Bloomington, Ill.: McKnight & McKnight Publishing Co., 1968.

Periodicals

Goetsch, David L. "Computer-Aided Drafting," **Industrial Education,** May/June 1981, Vol. 70, No. 5.

Goetsch, David L. "Using a Computer As a Drafting Tool", **School Shop,** May 1982, Vol. 41, No. 10.